APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

SEPTEMBER, 1951

SEP 24 1951

- HYDRAULIC CIRCUITS
- HYDRAULIC CONTROLS
- AIR CIRCUITS
- AIR CONTROLS
- ELECTRICAL AND ELECTRONIC CONTROLS

IN THIS ISSUE

- INGENIOUS APPLICATION OF THREE FLUIDS SPEEDS HYDROSTATIC TESTING
- DANGER SPOTS IN HYDRAULIIC CIRCUITS
- LONG STROKE SHUTTLING CYLINDER REDUCES CYCLE TIME
- IMPROVED COMPONENTS HIGHLIGHT NEW GRADALL DESIGN
- "FLOATING" GLAND DESIGN FOR LONG "O" RING LIFE
- A PROGRESS REPORT — NONFLAMMABLE FLUIDS

"BREAKAWAY"

For efficient operation of hydraulically-controlled implements, the Aeroquip "Breakaway" Coupling is the ABC rule. This rugged, field-proven unit provides two important services: it eliminates the breaking of hose lines and loss of hydraulic fluid whenever the implement breaks away from the tractor; it permits quick, easy connection and disconnection of implements and tractor. (Photo courtesy of International Harvester Company.)

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The "Breakaway", consisting of twin Self-Sealing Couplings mounted on a frame, connects both hydraulic pressure and return lines between tractor and pull-behind implements. The "Breakaway" can be separated by a tug on either hose line or by tripping the trigger manually. When uncoupled, both halves seal automatically keeping hydraulic fluid in and preventing dirt and air from entering the hydraulic system. The "Breakaway" can be reconnected easily even when under pressure. Operation is simple and foolproof.

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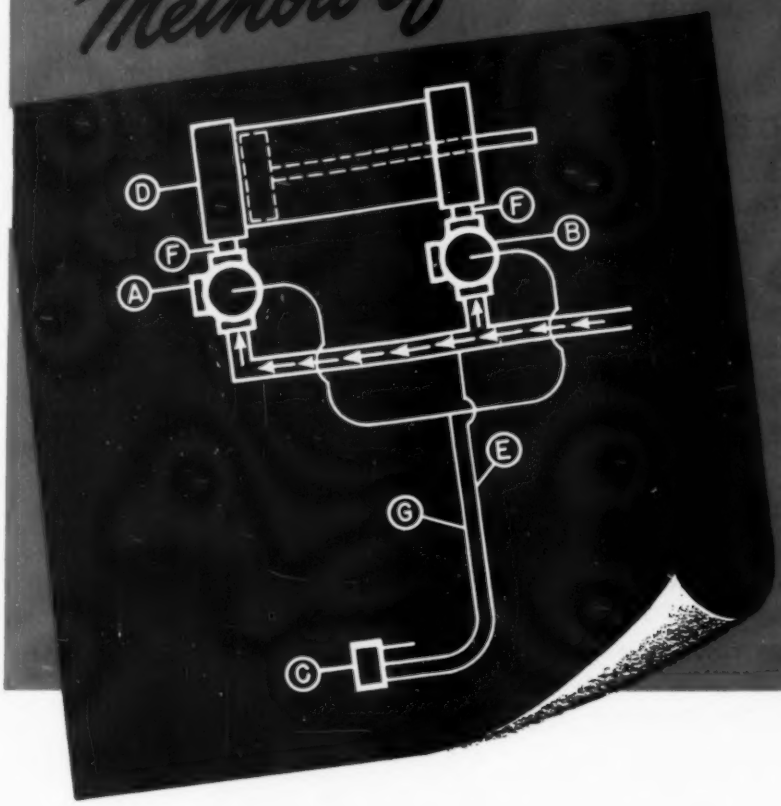
How to Boost Production with new Method of Mounting Ross Valves



★ Faster Machine Speeds

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Close-coupling of valve to cylinder! That's the story behind the remarkable success of the *new Ross In-Line Master Valve.*

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applied HYDRAULICS

September, 1951 Vol. 4, No. 9

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EDWIN M. JOSEPH, V. Pres.
JEROME R. PESKIN, V. Pres.

Editorial and Business Office
1240 Ontario Street
Cleveland 13, Ohio
Phone: SUperior 1-9622

AT&T Teletypewriter
Number is CV-223

JEROME R. PESKIN
Vice President in Charge

PAUL L. REED
Editor

PAUL ROLNICK
Associate Editor

•

Production Department
WILLIAM L. JERSE

•

Circulation Department
E. M. JOSEPH
Director

•

NEW YORK OFFICE
STEPHEN SHEPARD
60 East 42nd Street
Room 805
New York 17, N. Y.
MUrray Hill 7-3420

CHICAGO OFFICE
S. R. TRACY
Room 734
520 N. Michigan Ave.
Chicago 11, Illinois
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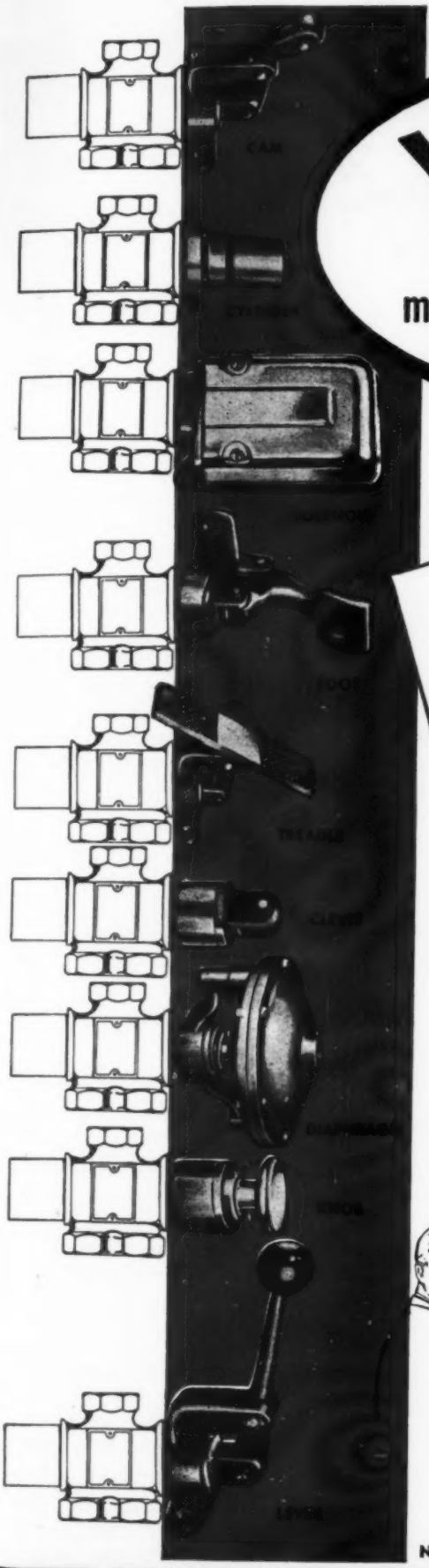
FRONT COVER: Valve bodies are hydrostatically tested on this special production test fixture. The article starting on page 47, in this issue, tells how Ohio Injector uses a special accumulator to develop high test pressures.



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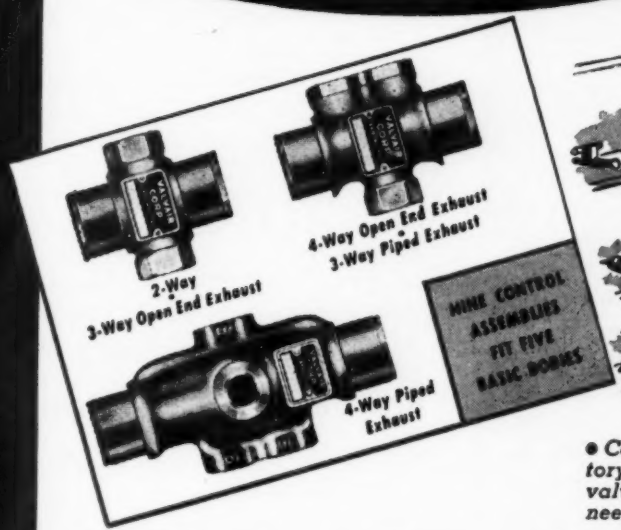

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No. 3

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Fluid Power Lines

George Allenbaugh, Sr., . . . design engineer at The Ohio Injector Company, Wadsworth, Ohio, is proud of the results of his work, as we believe he should be. Behind his story "Ingenious Application of Three Fluids Speeds Hydrostatic Testing" is a very considerable backlog of experience in the design of production as well as testing equipment for steel and non-ferrous valves. His modification of an accumulator to use water instead of air was approved by the accumulator manufacturer without reservation; his use of an air pilot cylinder to replace a solenoid simplified his circuits, made control easier and the test cycle faster.

Nonflammable Fluids . . . What's the status of present day developments of fluids which won't catch fire? The newest fluid is Holllingshead's H-2. Fred O. Hosterman, who has been active for many years on SAE aircraft committee work, gives a complete progress report covering all major classes of synthetic nonflammables in this month's Aviation Section.

Housing Boom . . . Production men in household appliance industries have been working closely with the special machine builder to get equipment which will meet high schedules. Circuit design of a special welder for kitchen sink drawer assemblies emphasizes new high production technique. A bar graph prepared by Harold Kruer of Precision Welder and Machine Co. quickly takes you through the cycle of operation.

Coming . . . Safety and efficiency go together. Circuit designers first make a layout to provide the required forces the next design step assures that these forces are fully tamed. Several articles describing steps taken by leading industries to build safety into production equipment are coming up . . . For your circuit file, the October issue will include designs for press ram travel . . . There'll also be articles featuring fluid power for metal working. Among them, the Navy describes a special mill for air-foil contours . . . Cole H. Morrow, chief plant engineer, J. I. Case Company, Racine, Wis. will tell how the Tractor Plant power house, in a program of general modernizing, became one of the highest efficiency installations in the country.

Visit to New Philadelphia . . . We stood in the cab of a new Gradall as Sterling Winchell, the division's chief engineer put it to work. A unique flow control valve automatically brakes the drop of the boom. Doesn't seem to require the critical coordination that the operator of most power shovels must have . . . therefore it takes less training time for the operator.

Rupert P. Esser . . . TEC Engineering's chief engineer gives the third set of Circuit Hints on the control of piercing tools . . . ideas which you can apply to many power circuits.

Beginner's Course . . . Running since March 1949, we've had many requests for tearsheets which we can no longer supply. Hope you've been saving your copies. This month it's "combination pumps". We plan to close the course with sections on transmissions, fluid motors and cylinders . . . after that . . . a pneumatic course.

Ceramic Press . . . Last month's "Another Industry Turns to Hydraulic Power" showed the time-saving advantages of oil presses in making ceramics. Information on the press used in many plants in this industry can be had from Benjamin Lassman & Son, Pittsburgh, Pa.

Mark Twain . . . didn't say it but engineers may be divided into three classes: conservative, careful and curious. The conservative go by "the book"; the careful follow new practices afar off; the curious create new designs and chart new practices. The floating gland design for longer "O" ring life described by T.J. McCuistion, pretty definitely puts "Tommy" in the curious class.

PRODUCT INDEX

Advertised Components in This Issue

This index includes products advertised in this issue; based on information available prior to closing date.

Accumulators
Greer Hydraulics, Inc.

Air Motor
Gast Mfg. Co.

Babbit, Lead Base
American Crucible Products Co.

Boosters
Sprague Engineering & Sales

Couplings, Flexible
Lovejoy Flexible Coupling Co.

Couplings, Self-sealing, Air
Aeroquip Corporation
Hansen Mfg. Co.

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Bellows Company, The
Hanna Engineering Works
Ledeen Mfg. Co.
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Mead Specialties Company
Miller Motor Co.
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Commercial Shearing & Stamping Co., The
Electrol, Inc.
Hanna Engineering Works
Ledeen Mfg Co.
Logansport Machine Co., Inc.
Neptune-Power Plus Products Co.
Ortman-Miller Machine Co., Inc.
Petch Manufacturing Co.

Filters, Oil
Capital Engineering and Manufacturing Co.
Dollinger Corp.
General Filters, Inc.
Hilliard Corporation
Honan-Crane Corporation
Marvel Engineering Co.
Skinner Purifiers Div. of Bendix Aviation Corp.
Sparkler Mfg. Co.
Waterman Engineering Co.

Filter, Regulator Lubricator, Air
M-B Products Co.

Fittings, Swivel
Barco Manufacturing Co.
Chiksan Co.

Fittings, Tube
Logansport Machine Co., Inc.
Parker Appliance Co., The
Weatherhead Company, The

Fluid Motors
Berry Division of Oliver Iron and Steel Corp.
Commercial Shearing and Stamping Co.
Sundstrand Machine Tool Co.

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Anchor Coupling Co., Inc.
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Hydraulic Equipment Co.
Pesco Products Div. Borg-Warner Corp.
Oberdorfer Foundries, Inc..

Pumps, Piston
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Blackhawk Mfg. Co.
Berry Division of Oliver Iron & Steel Corporation

Pumps, Reciprocating Plunger
Worthington Pump & Machinery Corporation

Pumps, Vane, Variable Volume
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LITERATURE AND SERVICES OFFERED INTHIS MONTH'S ADS

HIGH PRESSURE HYDRAULIC STRAINER protecting valves and cylinders in systems operating at pressures to 1500 psi are fully detailed in C. B. Hunt & Son, Inc. Data Sheet 3402.

Circle 10 on Reader Service Card

HYDRO-DRIVE BULLETIN offered by E. F. Houghton & Co. gives complete specifications on this treated hydraulic fluid.

Circle 41 on Reader Service Card

GEAR PUMP PERFORMANCE DATA can be had from the Hydraulic Equipment Company.

Circle 20 on Reader Service Card

ACCUMULATOR applications, ideas, and circuits are provided in Greer Bulletin 301.

Circle 54 on Reader Service Card

OIL FILTER SPECIFICATIONS for hydraulic pressure systems are offered by General Filters, Inc.

Circle 52 on Reader Service Card

AIR MOTOR application ideas booklet showing 26 design problems solved with Gast air motors will be sent upon request.

Circle 8 on Reader Service Card

MECHANICAL DATA HANDBOOK giving drawings and specifications on Fulflo Specialties Co., Inc. products is offered.

Circle 61 on Reader Service Card

IRON BODY ROTATING AIR CYLINDERS are detailed in Cushman Bulletin PO-8.

Circle 21 on Reader Service Card

PUMP CATALOG contains complete specifications on Brown & Sharpe gear pumps.

Circle 38 on Reader Service Card

(Continued on page 14)

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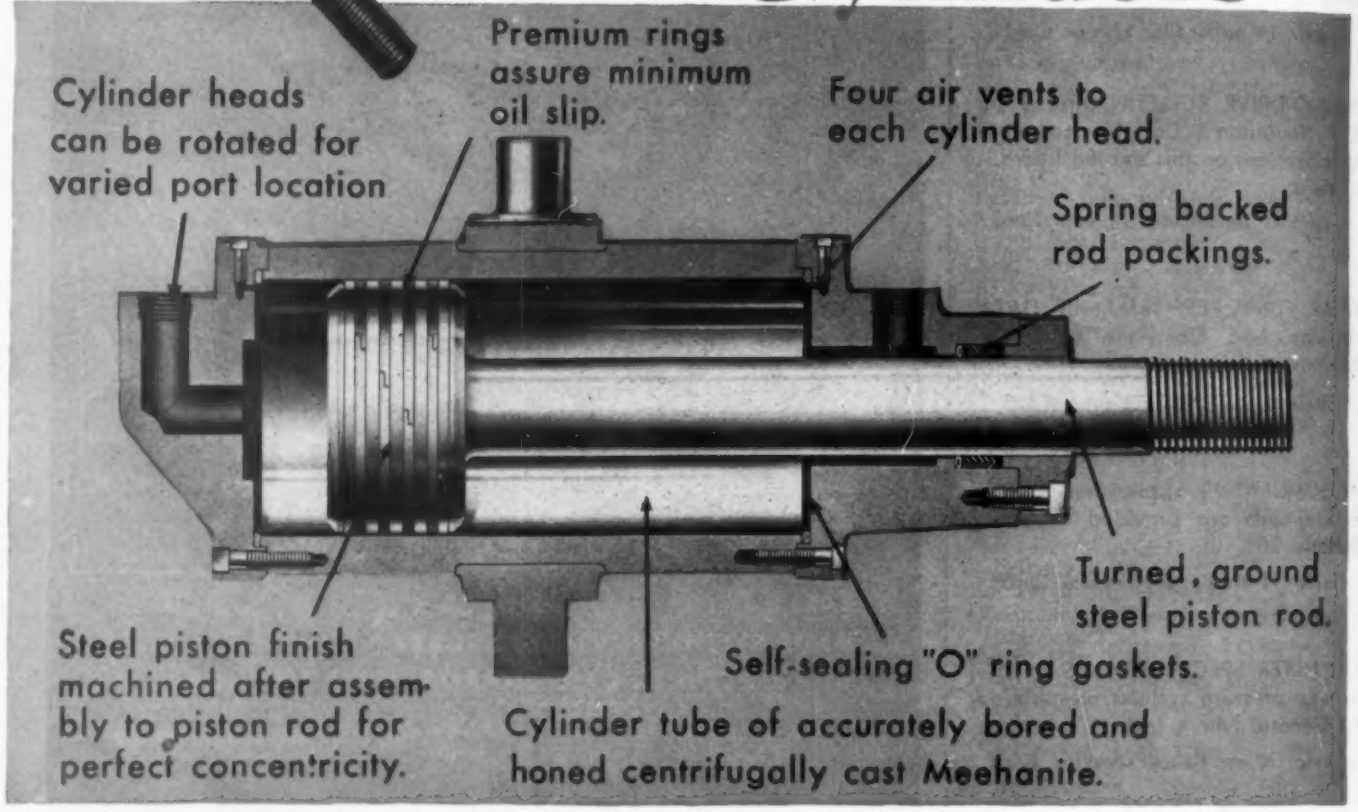
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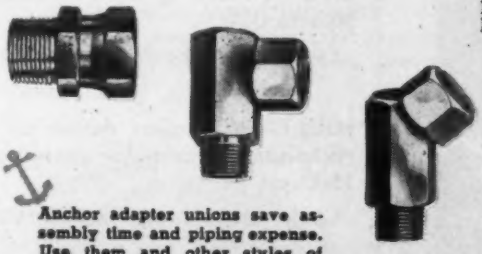

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FOR longer service life — you design your machines with great care and manufacture them to rigid tolerances.

But the job is not done until you invest the same care in selecting and specifying hose units. After all, the performance of your machines is dependent upon them.

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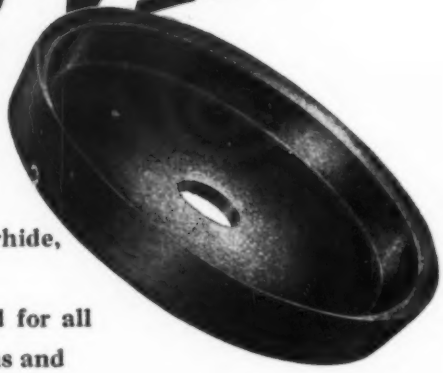

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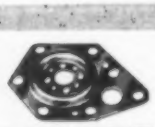

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Literature Offered in This Month's Ads

(Continued from page 11)

"HYDRAULIC BULLETIN" offered by Honan-Crane Corp. describes in detail the cost saving advantages of oil purifiers.

Circle 68 on Reader Service Card

CATALOG 233-A prepared by Hanna Engineering Works gives complete information and specifications on Hanna HP hydraulic cylinders for pressures to 1500 psi.

Circle 24 on Reader Service Card

FACTORY ASSEMBLED Anchor hose units, to meet your specifications are detailed in Bulletin 49S.

Circle 25 on Reader Service Card

DESIGN, installation and recommended practice data for "O" rings are given Catalog "C" and Bulletin P-112 offered by Goshen Rubber Co. Inc.

Circle 4 on Reader Service Card

OIL FILTER RECOMMENDATIONS are offered by The Hilliard Corporation.

Circle 79 on Reader Service Card

SERIES of Catalogs is offered by Logansport Machine Co., Inc. covering their line of air and oil components.

Circle 60 on Reader Service Card

AIR POWER Catalog describes the Mead line of air devices.

Circle 81 on Reader Service Card

SPECIFICATIONS for Monsanto's Pydraul F-9 are given in Technical Bulletin 0-75.

Circle 45 on Reader Service Card

BULLETIN 651 gives details on the Nicholson air traps for pressures to 1500 psi.

Circle 78 on Reader Service Card

HYDRAULIC POWER UNITS are the subject of a fully illustrated Catalog available from Rivett Lathe & Grinder Inc.

Circle 50 on Reader Service Card

(Continued on page 20)

Circle 26 on Reader Service Card

HERE'S THE ULTIMATE IN

Controlled AIR CYLINDER POWER

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The BELLOWS AIR MOTOR

Built-in Electrically-Controlled Directional Valve

•

Built-in Piston Rod Speed Controls

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Requires only a Single Air Connection

Model illustrated — Electrically controlled BEM-5-40 2½" bore, 4" stroke air motor.

The Bellows Air Motor combines air cylinder, electrically controlled air-powered directional valve, and two independent piston speed controls all in one integral power unit . . . a unit that requires only a single air connection which can be made with flexible hose.

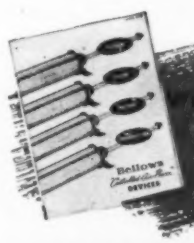
Here's compactness and flexibility to the N'th degree. The Bellows Air Motor makes designing for electrically-controlled air operation simple. No bulky power solenoids. No cumbersome, clumsy piping. No complex air circuits.

The unique Bellows ELECTROAIRE* valve gets away from bulk and weight by using the air-power itself to shift the valve, tiny built-in 8-volt solenoid controls to direct it. Makes the whole set-up safe from electrical hazard, safe to operator, safe to machine. The Electroaire valve will operate submerged, flooded with coolant, piled high with chips or dust. And the tiny solenoid control units are guaranteed against burnout!

Integral construction means *quick, responsive power, controlled power, safe power.* For any air cylinder operation the Bellows Air Motor offers maximum effectiveness, minimum over all cost.

*TM Reg. Patent Pending

1167-1



Write for your FREE copy of Bulletin CA-50. Address Dept. AH 951

The Bellows Co.

AKRON 9, OHIO

FIELD ENGINEER OFFICES IN ALL PRINCIPAL CITIES

Manufacturers of "Controlled-Air-Power" Devices, including conventional air cylinders, air motors, air-powered rotary work feed tables, air-powered machine tool feeds, air-operated work holding and clamping devices.

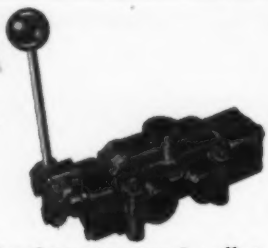
ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

GEAR-TYPE HYDRAULIC PUMPS

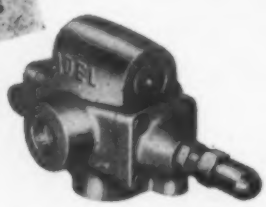
For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES



4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

VOLUME (FLOW) CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES

Valves allow free flow in one direction only. Many variations available. 3000 psi.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

For complete engineering specifications and counsel, Address: ADEL DIVISION—GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL ...RPORATION · Burbank, Calif.

Manufacturers of Industrial Hydraulic Valves and Pumps

DISTRIBUTORS: AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAULIC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. F. SODERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • INDUSTRAIL AIR & HYDRAULIC EQUIPMENT CO., DETROIT, MICH.

Literature Offered in This Month's Ads

(Continued from page 14)

CUTTING PRODUCTION COSTS is the subject of an informative booklet issued by Bendix-Westinghouse Automotive Air Brake Company.

Circle 89 on Reader Service Card

FLOW CONTROL VALVE providing cylinder speed adjustments for air or hydraulic use is described in an illustrated circular offered by Pneu-Trol Devices, Inc.

Circle 80 on Reader Service Card

HEAT EXCHANGERS for cooling hydraulic fluid are the subject of two catalogs prepared by Young Radiator Company. Both fixed and removable tube exchangers are described.

Circle 88 on Reader Service Card

PHOTOELASTIC STRESS analyses and radial pressure tests are given in a new Raybestos-Manhattan, Inc. Vee-Flex bulletin.

Circle 53 on Reader Service Card

ALL BRONZE PUMPS for liquid transfer where space is at a premium are described in available literature from the Industrial Pump Division of of Oberdorfer Foundries Inc.

Circle 44 on Reader Service Card

PNEUMATIC STANDARDS carefully prepared in a handy reference folder can be obtained from the Miller Motor Company.

Circle 34 on Reader Service Card

FILTER, REGULATOR AND LUBRICATOR assembly for air line protection are described in material available from M-B Products.

Circle 12 on Reader Service Card

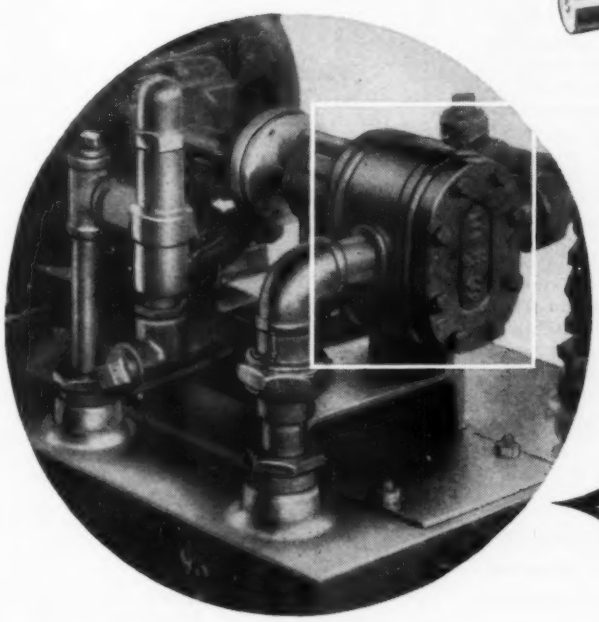
CYLINDERS, VALVES AND VALVE ACTUATORS are detailed in three separate Bulletins prepared by Ledeen Mfg. Co.

Circle 86 on Reader Service Card

METALLIC PACKING for increasing the life of hydraulic cylinders are described in literature offered by Hydraulic Accessories Co.

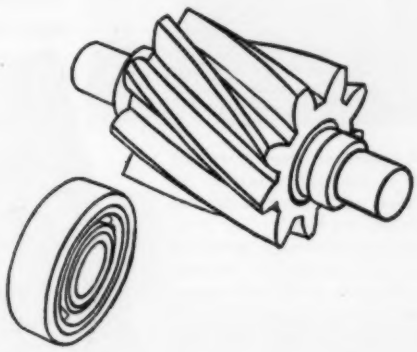
Circle 11 on Reader Service Card

Stock Pumps with "Custom-Made Performance...



for hydraulically-operated machines

Nos. 53 and 55
ROTARY GEARED PUMPS
with Helical Gears and Roller Bearings



Smooth, quiet operation . . . uniformly dependable flow . . . extended pump life without maintenance troubles! These are advantages you can count on, when you specify Brown & Sharpe Rotary Geared Pumps with helical gears and roller bearings as original equipment for hydraulically-operated machines.

Designed with extremely accurate helical gears and roller bearings, Brown & Sharpe No. 53 and 55 Pumps have served as standard equipment for low-pressure hydraulic systems on a wide variety of machines, such as stokers, shoe machinery and machine tools and also for many transfer applications.

Capacities: No. 53—4 to 23.3 gals. per min. at 0 lbs. pressure; No. 55—9 to 34.1 gals. per min. at 0 lbs. pressure. Direct drive, or may be driven by pulley or gear. Run in one direction only, either clockwise or counterclockwise.

Write for Pump Catalog containing complete specifications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

WE URGE BUYING THROUGH THE DISTRIBUTOR

Brown & Sharpe

SPARKLER FILTERS

. . . KEEP HYDRAULIC OILS CLEAN

. . . KEEP IMPORTANT ADDITIVES INTACT

. . . ARE VERY LOW IN COST

Modern hydraulic oils are carefully compounded to insure longer life for expensive machinery. That's why it is so important to take proper care of the oils themselves.

Sparkler Model VR filters, employing an adaptation of the unique horizontal plate principle and strictly mechanical filtration, remove all impurities from hydraulic oil without removing or affecting any of the oil's special properties. And because Sparkler filters extract all gums, varnishes, sludge, rust and grit, leakage and drainage oils can easily be reclaimed, thus making possible large savings in new oil requirements.

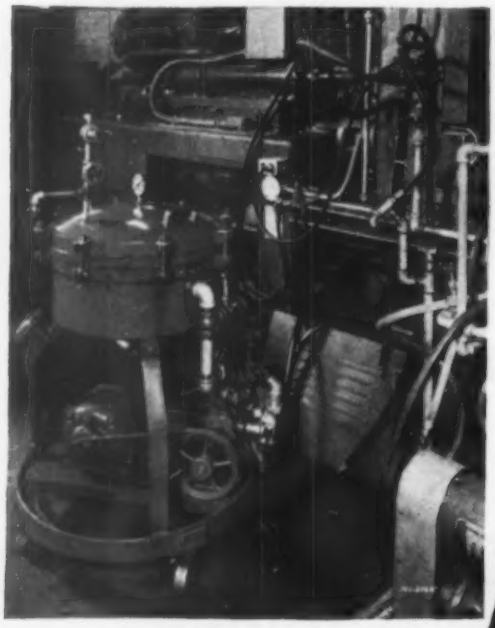


Photo shows Sparkler filter installed on injection moulding machine in plastics division of Nash-Kelvinator Corp. at Milwaukee, Wis.

Filter is used to remove impurities which collect in hydraulic oil during moulding operation and such metal particles and bits of packing as might accumulate during operating cycle of any machine.

This particular unit is also used to filter drainage oil batchwise.

You get greater protection with Sparkler because horizontal plate design utilizes only surface-type filtration, easily trapping the most minute particles. Sludge can never form a channel through which unfiltered oil can by-pass the filter element. Also, extreme flexibility makes these Sparkler units adaptable for use as permanent installations on large hydraulic systems or as portable equipment to handle a number of machines.

Available in a complete range of sizes and types to handle any problem. For full information or engineering assistance, write Mr. Eric Anderson.

SPARKLER MFG. CO.
Mundelein, Illinois

Manufacturers of fine filtration equipment for more than a quarter of a century

SPARKLER gives you these "EXTRAS," too

1 Uses disposable media.
2 Low operating cost (complete refill for average Sparkler filter costs less than one dollar).
3 Selective filtration — operator quickly adjusts for degree of filtration best suited to each application.
4 Compact design needs little floor area.
5 Simplified cleaning.
6 Easy operation.

The Model VR version of the horizontal plate provides exceptionally large filtering area in standard size tanks, at very low cost. It is particularly well-suited to hydraulic oil filtration and to any large volume operation. Ask for new Model VR catalog.

Circle 39 on Reader Service Card

LETTERS to the Editor

In the May issue of APPLIED HYDRAULICS, I read with interest your announcement of a course in Hydraulic Power Control to be given at M.I.T. It has been impossible for me to attend but I would be pleased to learn if it would be possible to purchase the notes.

A.M.

If you will write to Professor John A. Hrones, in charge of the Dynamic Analysis and Control Laboratory, M.I.T., Cambridge 39, Mass., he will advise you regarding the availability of the Hydraulic Power Control course notes. This short course was given under Professor Hrones' supervision.

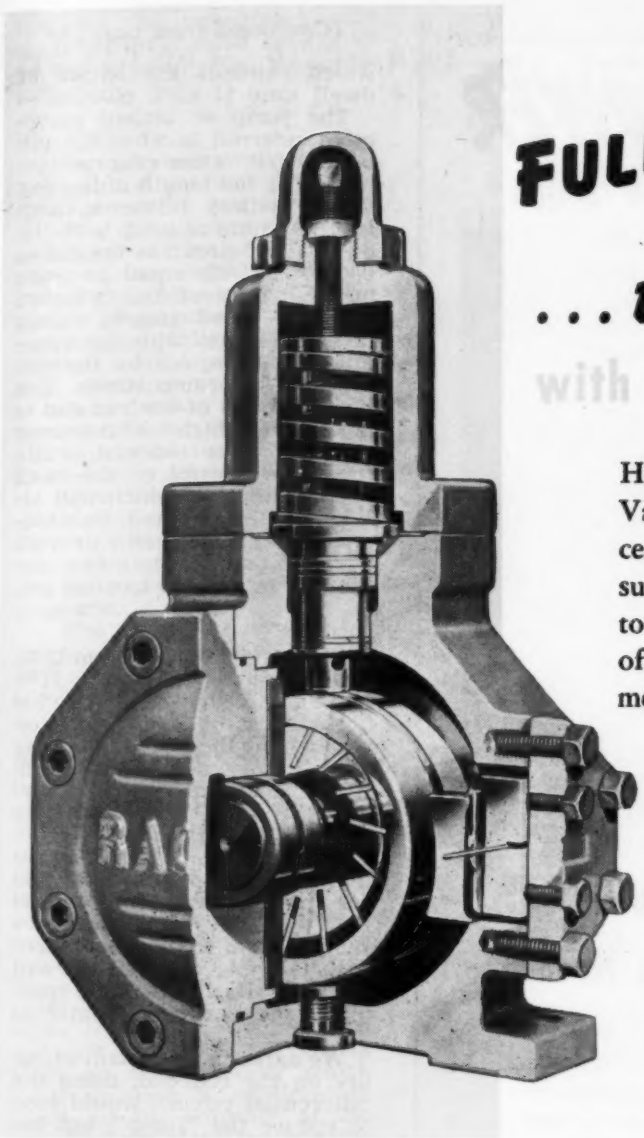
We have had an exchange of correspondence regarding the sample pneumatic chart published in the J.I.C. Pneumatic Standards for Industrial Equipment, which picked up the title of "Operation Rhubarb" in the process. We pass it on to our readers slightly abridged.

We have studied the JIC symbols in the Standards with a great deal of interest. Does the equipment set up according to the diagram really operate? We believe that the forces on the head and rod ends of the cylinder must be equal to hold the piston in a latched position and that when the latch is released from the lock position, the cylinder will jump or move violently because of the differential in pressure between the rod and head ends of the cylinder. It's possible that some of the details have been omitted from the complete circuit including a position for checking or damping the movement of the piston.

E.H. & C.H.

The circuit as it appears in the Standards is in actual operation on a camshaft induction hardening machine in one of our plants. Each notch on the bar represents a positioning stop in the induction ring for the lobes and bearings on the camshaft. The whole operation from start to finish is controlled by an electric timer

(Continued on page 32)



FULL VOLUME HIGH PRESSURE

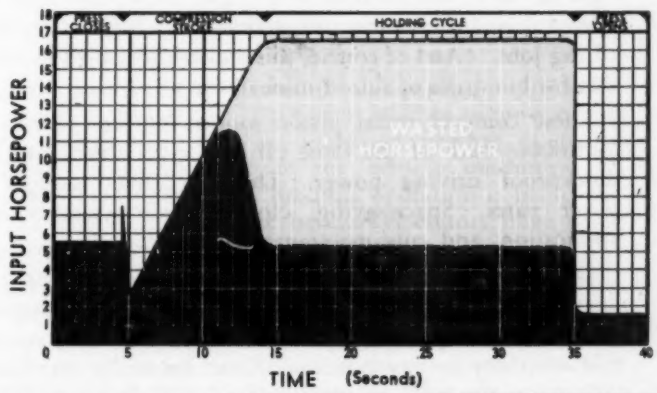
. . . BUT LOW HORSEPOWER

with RACINE *Hydraulic* PUMPS

High pressure holding is economical with RACINE Variable Volume Pumps. They will automatically cease their pumping action but maintain full pressure in the system. Instant change from no volume to full volume insures smooth, sure application of hydraulic force. Horsepower requirements are measured by the actual needs of the job — all of the oil is put to work.

RACINE Variable Volume Pumps eliminate the need for relief valves — reduce oil heating — save horsepower and lower the over-all cost of most circuits.

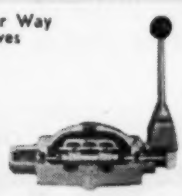
Various standard governors are available for RACINE Pumps. These governors develop the pumping action that will best handle special requirements of the circuit. Maximum efficiency is assured.



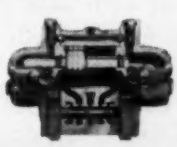
The graph to the right illustrates the horsepower savings in a simple press circuit using a RACINE *Variable Volume Pump and Pressure Booster. The area in color represents the bypassed oil from a constant volume pump — lost power that is saved with* RACINE *Equipment.*

OTHER RACINE HYDRAULIC PRODUCTS

Four Way Valves



Pressure Boosters



Pump & Reservoir Units

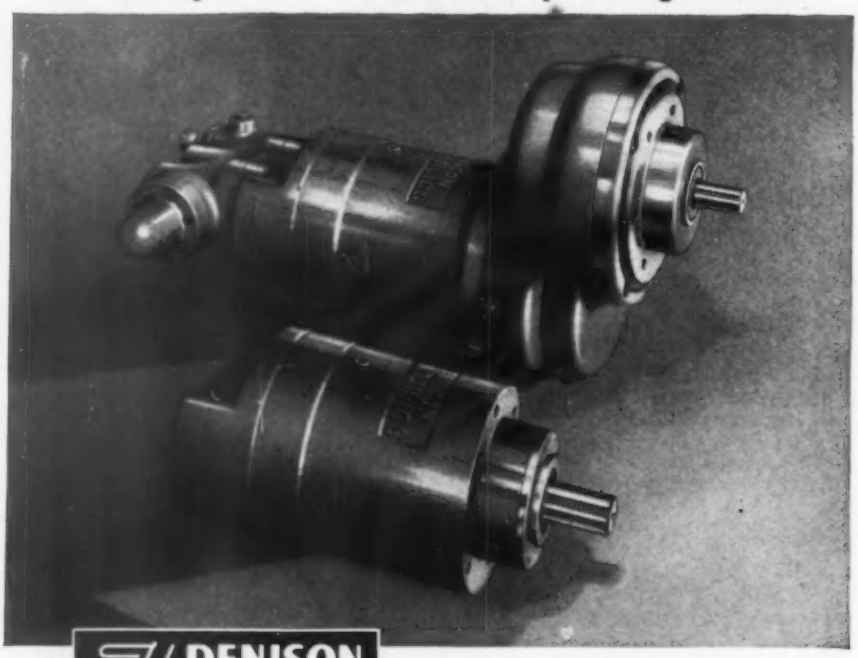
Write for complete catalog and engineering data.

RACINE TOOL & MACHINE COMPANY

1774 State Street, Racine, Wis., U. S. A.

SHOCKPROOF ROTARY POWER

stands up under constant stop-and-go action



DENISON HydrOlics

Denison Fluid Motors

Are Built for Tough Rotary Drive Needs

Do you need *tough* rotary drives that laugh off the *continuous abuse* of sudden, jolting starts . . . lightning acceleration . . . split-second stops . . . powerful braking action . . . instant reversals, and other punishment? Denison Fluid Motors meet these demands with smooth-working ease and efficiency. They've proved their long-wearing ruggedness on a wide range of motor-killing jobs. (And of course, this makes them even more dependable for hundreds of run-of-mine needs.)

These compact, axial piston motors are self-lubricated in a continuous bath of the same oil that gives them their efficient, shockproof driving power. Their improved design features fewer parts. Space-saving, close-coupled assembly simplifies application, and cuts maintenance costs.

Denison Fluid Motors are built in 3hp to 160hp sizes, for operating pressures to 5000 psi. Torque ratings range to 5580 inch-pounds. Operating speeds to 3000 rpm. They operate with full efficiency in any position. Gear reduction attachments (as shown on top unit in photo above) are available for smaller models. A choice of face, flange or foot mountings is also offered. Drop the word and we'll send you full information on Denison Fluid Motors that fit your needs.

The DENISON Engineering Co., 1166 Dublin Rd., Columbus 16, Ohio

DENISON FLUID MOTORS

(Continued from page 28)

which controls the length of dwell time at each position.

The jump or violent movement referred to when the pin is removed, is the effect we intended as the length of heating time is critical. However, there is a minimum of jump with the differential circuit as the stroke is started with equal pressure on both ends of the cylinder. The two speed control valves in combination with the operating pressure, control the distance of the jump stroke. The speed control of the rod end is meter out, which will compress the air in the rod end, while the speed control on the head end is meter in, which will allow the air to expand, thus balancing the forces and provide a rapid cushioning action for the entrance of the locating pin.

D.M.

We have the letter from D.M. and we remain stubborn. It is our thought that the "jump" is not a constant at any position throughout the stroke. Starting with the piston fully retracted, with the rod end up to pressure, the initial step would be made with a minimum "jump". If the latch is in the notches long enough to allow the rod end pressure to drop back to line pressure, each successive jump would be more violent than the preceding one. It will work ideally if the notch spacing is progressively greater as the cylinder advances.

We agree that constant pressure on the rod end, using the differential circuit, would tend to reduce the "jump", but believe that this is relative and variable throughout the stroke. We also believe that if, as D.M. states, the circuit is in operation on a machine, one or more of the following must be true:

1. The notch spacings vary with a progressive increase in spacing which bears some relationship to the changing volume ratios.
2. The latched time is an extremely short interval which does not allow for the pressure on the rod end to drop after compression.
3. Something has been added which is not shown.
4. Those who operate and maintain the equipment are not too hard to please.

To summarize we would say that if this arrangement works satisfactorily it must be on the basis of very unusual requirements and its acceptance for general application would certainly lead to a liberal educa-

tion for the uninitiated who would adopt it as an answer to what may seem a similar application.

E.H. & C.H.

In my previous explanation it was pointed out that the rapid forward motion was the effect intended. No attempt was made to control the length of movement to any minute distance by the cylinder alone. The sequence of operation on the circuit diagram fully explains the function of the pneumatic circuit. Nothing was eliminated or added for any reason. The latched time is a short interval. The unlatched time is a much shorter interval except initially, when Sol B is held energized pending pressure build-up in the head end of the cylinder to start forward motion and in returning at the end of the cycle.

The two speed control valves, "meter in" and "meter out", are so adjusted that from the start of the cycle, when Sol A is energized until LS 2 is tripped to de-energize Sol A, there is both a pressure rise on the rod end and a pressure drop on the blank end of the actuating cylinder in relation to the supply pressure. With the use of the differential circuit and the variable speed controls, we were better able to control our speed and forces in relation to the mass and friction involved. The tendency is for a very rapid start with a decreasing force on the head end of the cylinder and an increasing force on the rod end, which tends to have a decelerating effect for the entrance of the pin. The pin being the positive locator, some cushioning of the mass had to be obtained to insure against over-riding of each position.

The circuit as it appears in the Pneumatic Standards was never intended to be a cure all for all circuit problems, but to illustrate the information that should be required on all pneumatic diagrams. I hope this closes Operation Rhubarb and that this explanation meets with Messrs. E.H. and C.H.'s approval.

D.M.

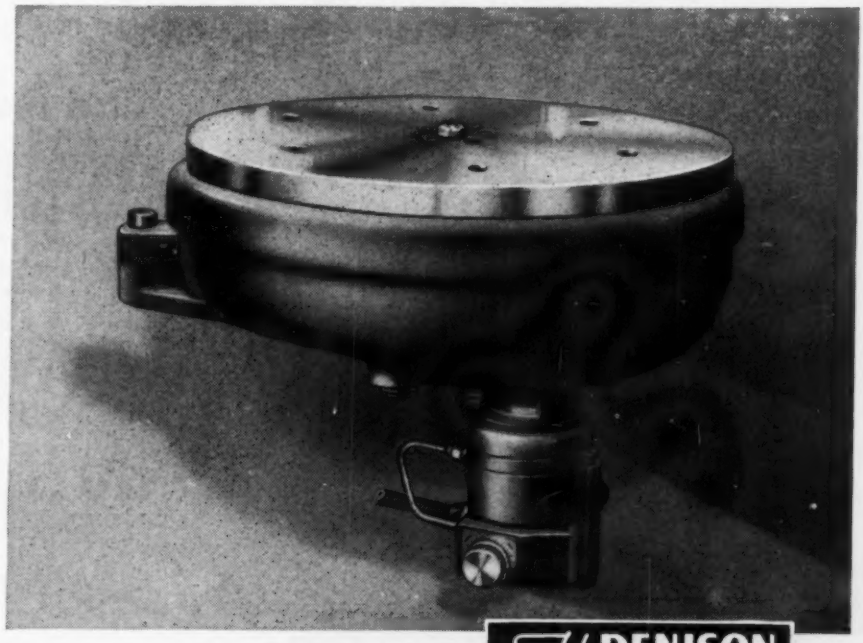
We are agents in the Territory (Hawaii) for several lines of hydraulic equipment. We have just received an inquiry from a valued customer for information on "Power Plus" hydraulic cylinders. We would like to know the name and address of the manufacturer.

R.A.R.

The manufacturer in question is Neptune-Power Plus Products Company, 2228 Bellevue Ave., Detroit 2, Mich.

FASTER ROTARY FEEDING

speeds loading on production operations



Denison Index Tables with DENISON HydrOILics

Fluid Motor Drive Adaptable to Many Machines

Driving the Denison Index Table shown above is a typical job for the tough, shockproof rotary power of Denison Fluid Motors, described on the opposite page. Available for either six or twelve-station indexing, these tables operate at speeds up to 70 indexes per minute. At top speeds, the motors have *less than one second* to leap from a dead stop to full speed, rotate the table 30 or 60 degrees, and return to a full stop. And they keep it up day after day, month after month.

A four-way gain is realized when machines are equipped with Denison Index Table Feeds. 1. Faster loading permits higher production speeds. 2. Safety is increased because operator's hands are never within reach of the moving machinery. 3. Operators can load parts while machine operation is being performed. 4. There's less fatigue because operators have maximum time for parts-loading without risk of injury.

The table is rotated and indexed by a Geneva arbor drive, actuated by the variable speed Fluid Motor. Table speeds are variable from 10 to 70 indexes per minute. Positive interlock between the operation of the table and the production machine can be provided. A cam track within the table dial permits a variety of automatic ejection devices. Skip-station controls are also available, where tooling is not desired at all index stations. Write for full details on Denison HydrOILic Index Tables.

The DENISON Engineering Co., 1166 Dublin Rd., Columbus 16, Ohio

DENISON
INDEX TABLES

Since the OBERDORFER INTERNATIONAL Pumps described below are new, with no prior history of use, Washington expects a DEFENSE ORDER or equivalent for their purchase. Free samples are available to O.E.M. accounts.

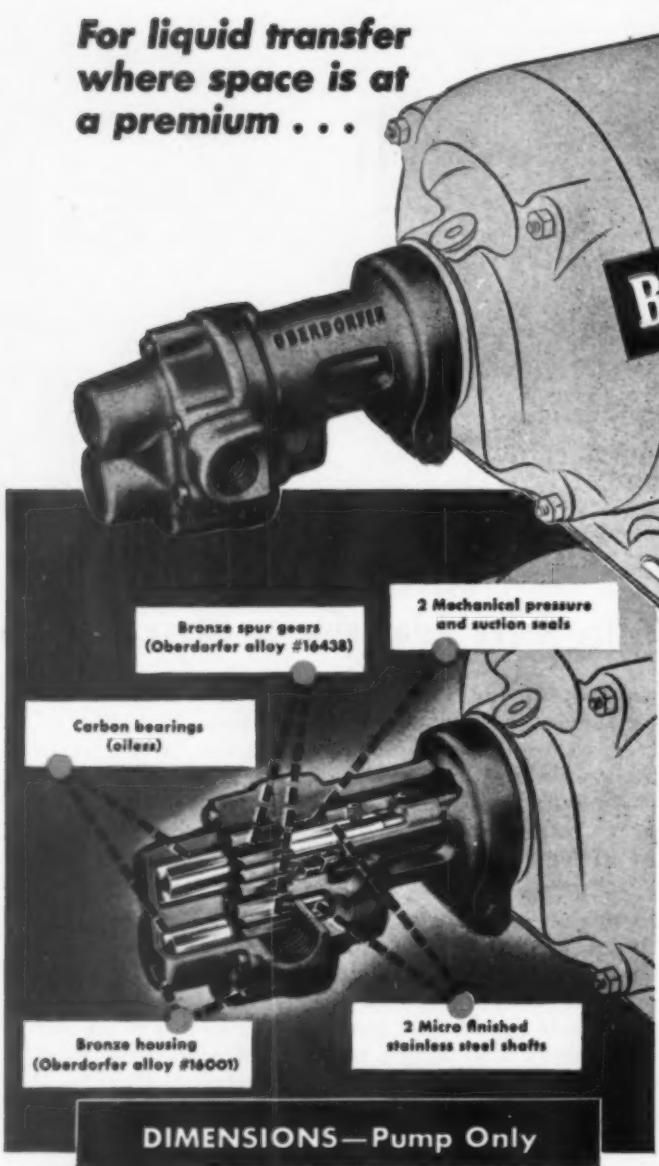
Introducing

The New Series 2

OBERDORFER INTERNATIONAL

BRONZE Close Coupled ROTARY GEAR PUMPS

For liquid transfer where space is at a premium . . .


OBERDORFER
Bronze spur gears (Oberdorfer alloy #16438)
2 Mechanical pressure and suction seals
Carbon bearings (oilless)
Bronze housing (Oberdorfer alloy #16001)
2 Micro finished stainless steel shafts

These two motor driven pumps have all-bronze housing and gears, oilless carbon bearings, micro-finished stainless steel shafts (± 25/100,000 of an inch) and are powered by heavy-duty ⅓ h.p. motors* equipped with thermal overload protection.

They are intended to be used wherever a liquid has to be moved from one location to another in quantities up to 240 gallons per hour at pressures from 0 to 100 lbs. per square inch.

They are adaptable for a wide variety of industrial and chemical applications where a corrosion-resistant pump is required and space is limited. Their all-bronze body and gears permit use with most liquids.

* **110 volt AC, Motor standard but specially machined for pump mounting.**

DIMENSIONS—Pump Only

Pump No.	Height	Width	Length
No. 1½	2⅞	2 11/16	4¾
No. 2	3 11/16	2¾	4⅞

GALLONS PER HOUR at 1725 R.P.M.

Pressure	Pump No. 1½ CCC	Pump No. 2 CCC
0 lbs.	120 gal.	240 gal.
25 lbs.	110 gal.	220 gal.
50 lbs.	100 gal.	190 gal.
75 lbs.	95 gal.	170 gal.
100 lbs.	90 gal.	——

PUMP No. 1½ CCC

Pump head only (⅜" pipe size).....list $20.00 F.O.B. Syracuse

Complete unit with ⅓ H.P. 110 volt AC thermal overload motor.....price on request

PUMP No. 2 CCC

Pump head only (⅜" pipe size).....list $22.50 F.O.B. Syracuse

Complete unit with ⅓ H.P. 110 volt AC thermal overload motor.....price on request

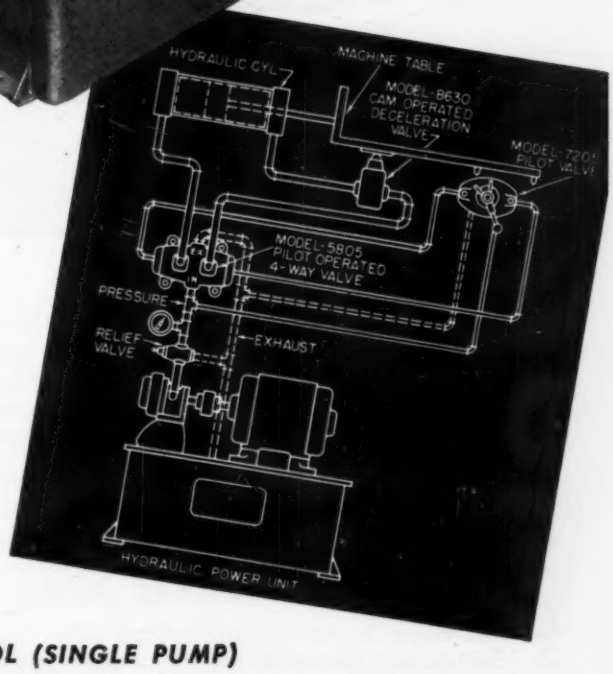
Write Dept. AH-519

INDUSTRIAL PUMP DIVISION
Oberdorfer Foundries, Inc.
Syracuse, N. Y.

YOU GET A

Complete Package

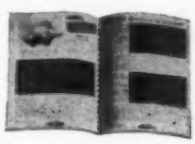
—with a RIVETT POWER UNIT



Rivett offers the Series 9100 Power Unit as the ideal source of power for your hydraulic circuit. The unit is equipped with pump, relief valve, oil filter, pressure gauge, and all equipment to furnish a steady flow of oil at continuous working pressures up to 1000 P.S.I. Reservoir is available in 5 tank sizes, with pump capacities from .4 G.P.M. to 40 G.P.M. Motor mounting may be arranged for any standard frame. Series 9200 with double pumps are supplied for two separate circuits of different pressures.

REMOTE PILOT OPERATED CONTROL (SINGLE PUMP)

Starting the electric motor results in the continuous reciprocating of the cylinder rod. In one position of the Model 5805 Pilot operated 4-Way valve, oil is directed from the pump to the blind end of the hydraulic cylinder, causing the cylinder to extend at its rated speed. When the machine table advances to where it depresses the cam of Model 8630 flow control valve, the forward speed of the cylinder is affected by the setting of the flow adjusting screw of Model 8630 valve. In the other position of Model 5805 valve, oil is directed from the pump to the rod end of the hydraulic cylinder causing it to retract at full rated speed. In this direction of cylinder movement, Model 8630 has no effect on the speed of the cylinder. Model 7205 Pilot valve provides for remote hydraulic operation of the main 4-Way valve, Model 5805. The forward, or return stroke of the cylinder may be manually interrupted at any time by reversing the handle of the Model 7205 Pilot valve.



Write for Catalog showing specifications and description of Rivett Hydraulic Power Units.

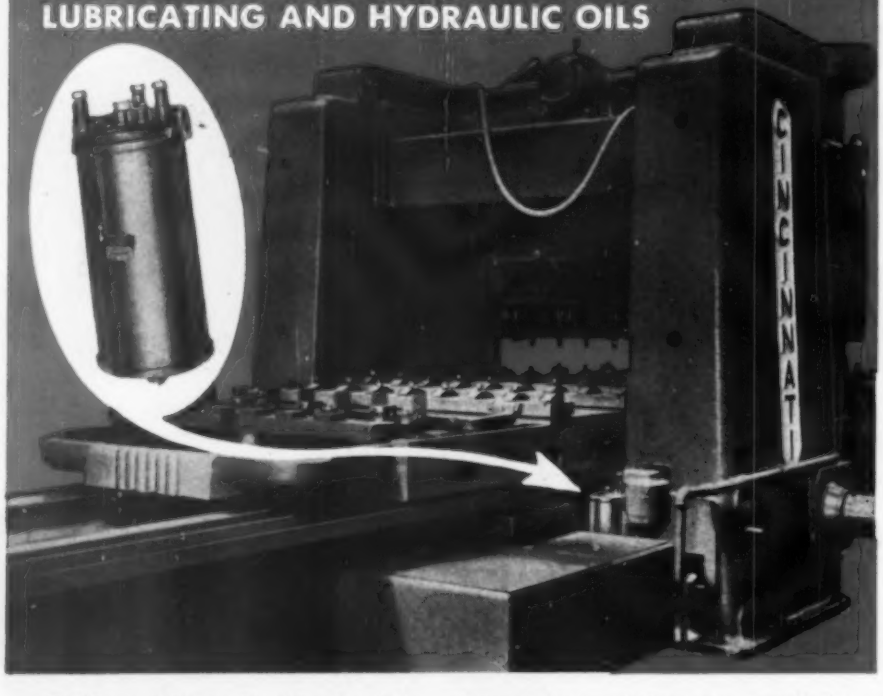
RIVETT LATHE & GRINDER INC. • Brighton 35, Boston, Mass.
Department AH-9

WHEN YOU APPLY HYDRAULIC OR AIR POWER *Plan with* **RIVETT**

AIR AND HYDRAULIC VALVES AND CYLINDERS, HYDRAULIC POWER UNITS

GIDDINGS & LEWIS CO. *Installs* GENERAL FILTERS

BECAUSE GENERAL INDUSTRIAL FILTERS *INSURE* ECONOMICAL PROTECTION FOR LUBRICATING AND HYDRAULIC OILS



Giddings & Lewis Machine Tool Co., of Fond du Lac, Wisconsin, installed a GENERAL AF-500 FILTER as original equipment on their 72" Cincinnati HYPRO Rail Guide Planer. This trend toward GENERAL is industry-wide. Manufacturers of quality machine tools want the longer machine life and lower maintenance costs that General Industrial Filters insure. That's why you'll find more and more GENERALS giving low-cost, day-by-day protection wherever volume quantities of lubricating or hydraulic oils are used.

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Hydraulic Conference Has November Dates

The National Conference on Industrial Hydraulics, which will hold its seventh annual meeting on Wednesday and Thursday November 7 and 8 at the Sherman Hotel, Chicago, will, for the second time, hold sectional meetings. This arrangement, begun last year, will assist registrants in their plans to attend the sessions of most direct interest and value to them.

J. J. Slomer of Goodman Manufacturing Co., Conference Director, announces that the Papers Review Committee reports the papers already received are of unusually high caliber. The complete program is expected to be one of the strongest and most practical in the Conference's history.

The Conference will again be sponsored by the Graduate School of Illinois Institute of Technology and Armour Research Foundation of Illinois Institute of Technology. As in the past, local sections and chapters of the American Society of Civil Engineers, American Society of Mechanical Engineers, Society of Automotive Engineers, American Society of Lubricating Engineers, American Institute of Chemical Engineers, Institute of Aeronautical Sciences, American Society of Agricultural Engineers, the Illinois Society of Professional Engineers and Western Society of Engineers will act as cooperating societies.

F. W. Edwards Conference Secretary, states that with a number of other industrial and technical meetings scheduled in Chicago for the same week, it is advisable that early registration and hotel reservations be made. For details on Conference registration, address F. W. Edwards, Conference Secretary, National Conference on Industrial Hydraulics, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

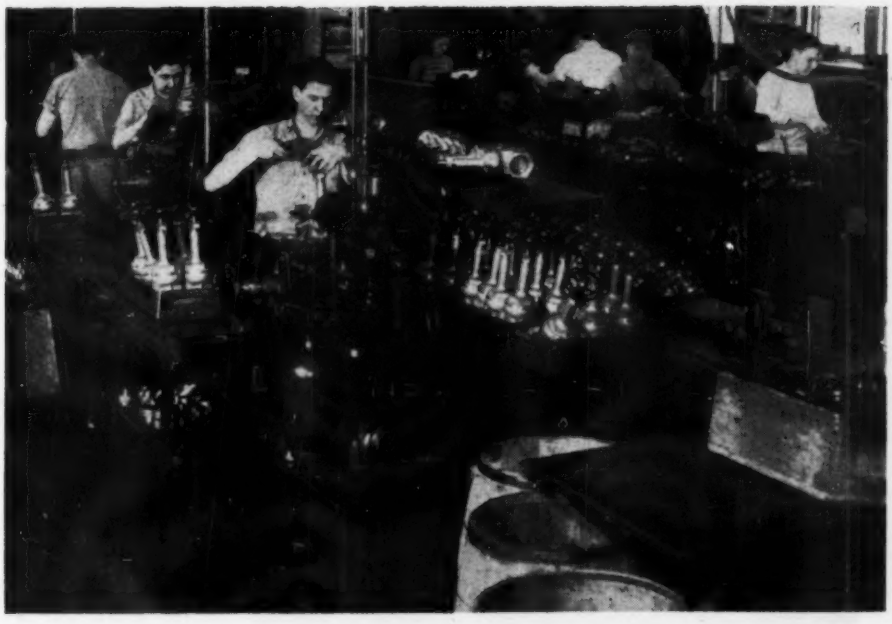


Fig. 1. Two test lines of three valve testing machines have a capacity of several thousand valves per day, of widely varying pressures, including both shell and seat testing. The setup utilizes an unusual combination of water, oil and air circuits.

By
GEORGE ALLENBAUGH, Sr.

Ingenious Application of Three Fluids Speeds Hydrostatic Testing

WE HAVE HAD A RATHER UNUSUAL SETUP for low, medium and high pressure testing of brass valves at The Ohio Injector Company in operation for about three years which utilizes a combination of air, oil and water circuits to simplify and accelerate both the shell and seat tests of globe, angle, check and gate valves. The testing equipment is versatile, it takes valves from ⅛ inch to 3 inches and tests them at pressures from 150 to 1250 psi; two lines of three machines each are capable of handling several thousands of valves per day. In addition to a very considerable gain in test production, the actual testing procedure has been simplified, defects identified more quickly and operator fatigue has been sharply reduced.

Essentially, the operation is to supply plant water which is put under pressure in a specially modified accumulator; actuate a four-way hydraulic valve to establish pressure and an air cylinder to close test fixture jaws by means

George Allenbaugh, Sr. is Design Engineer with The Ohio Injector Company, Wadsworth, Ohio.

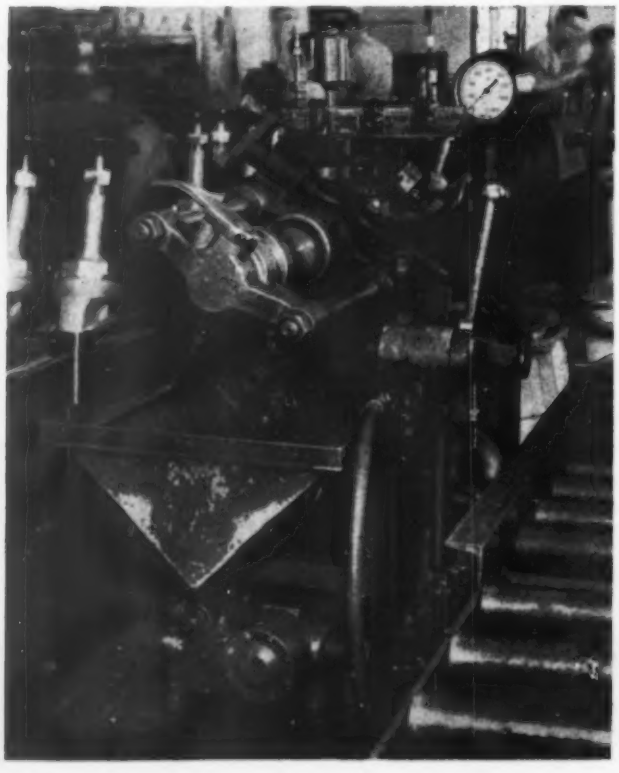
OIL—boosts water test pressure using special accumulator as pressure transfer device

AIR—controls oil flow and speeds fixture action

WATER—is the test fluid for checking valve bodies

Fig. 2. A front, closeup, view of one of the test setups. The operator has just opened his test control valve, admitting high pressure water into the valve in the test fixture.

Fig. 3. Rear or operator's position of a test machine showing seal on open fixture face, gauge, test control valve, combination pump and the relief valve with its pressure adjusting stem.



of a modified, treadle operated foot valve. The operator reads his gauge, makes a visual inspection for leaks, marks the valve accordingly and reverses a hand lever to cut off the water supply from the accumulator. By stepping on his treadle again, the foot valve, the four-way hydraulic valve and the toggle air cylinder are reversed and the jaws of the test fixture open, ending the cycle.

Air Circuit

The air circuit initiates the cycle. The operator steps on the treadle, connected to the four-way, two position foot valve (set for indefinite release.) This actuates the air pilot (dash pot air cylinder) to move the spool of the spring return, four-way hydraulic valve, as well as the air cylinder connected to the toggle. As soon as the test jaws are closed, by action of the toggle, a part of the air is diverted to a special single acting air cylinder (brake cylinder) which moves a piston back toward the rear of the machine, locking the brake band around the rear toggle trunnion. This action, ⅛ inch or less, does not add pressure on the test fixture faces; the mechanical holding pressure of 100 pounds or less is established by two springs so that the valve body being tested is not under any deformation pressure—the valve literally "floats in air".

When the operator steps on the treadle the second time, the foot valve reverses, in turn reversing the toggle cylinder and the air pilot controlling the spool of the four-way spring return hydraulic valve.

Shop air of 100 psi is fed through a lubricator unit to the foot valve. The inlet and outlet lines of the toggle cylinder are fitted with needle type speed control valves, restricting the exhausts.

Air is also used at the end of each test cycle to "wipe" water from the valve.

Oil Circuit

The purpose of the oil circuit is to boost the pressure of the water which has been trapped inside the accumulator bladder at approximately 50 psi. The four-way hydraulic valve (which, in this case, also acts as an unloader for the combination pump) operated as noted above, by air pilot, diverts the oil from tank to the connection at the lower end of the accumulator shell. The air pilot supplants the conventional solenoid.

A combination vane pump and relief valve unit, with a low pressure delivery of 6 gpm and a high pressure delivery of 1 gpm, is driven by a 3 hp, 1200 rpm motor. Pressure adjustments for various size valves that are tested are quickly and easily made, manually, on

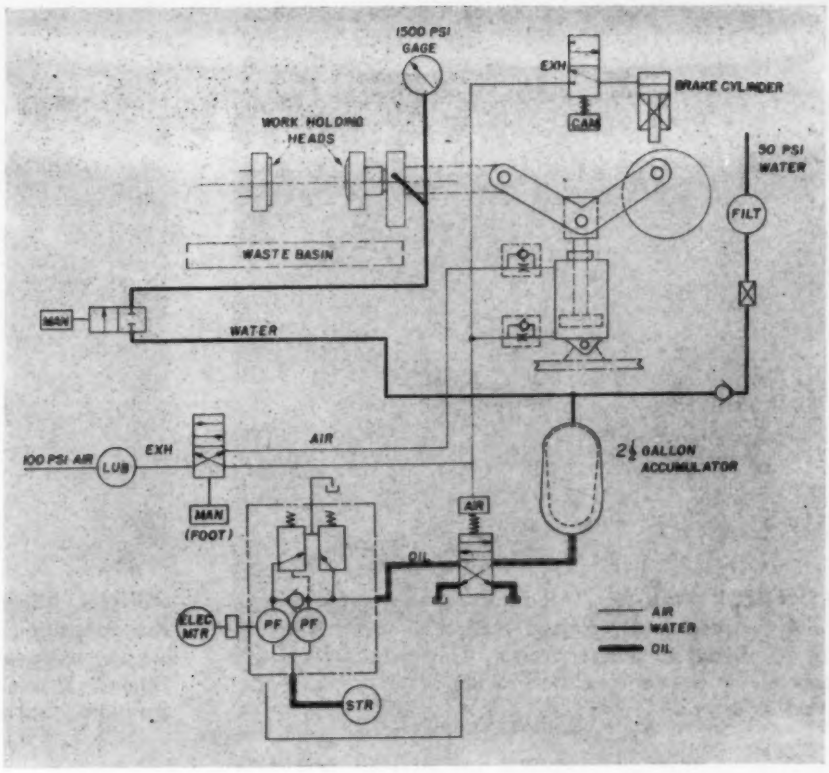


Fig. 4. Combination water, oil and air circuits.

the stem of the relief valve.

Both the high and low pressure volumes are directed through the air pilot operated four-way valve to the oil side of the accumulator. The modifications made in the standard hydro-pneumatic accumulator are detailed below.

The function of the low pressure pump is to minimize the time required to fill the cavity of each valve tested and is automatically unloaded by the high pressure pump which sustains the oil pressure in the accumulator and consequently the water pressure in the valve under test.

Water Circuit

Water is used for the actual pressure testing. A supply line of 50 psi, equipped with a filter and a high pressure check valve, is connected to the top side of the special accumulator, the inlet port on the test control valve and the pressure gauge. The test control valve, designed as a three-way, wide range valve, is manually operated by the movement of the handle, which shifts easily at all pressures, thus reducing op-

(Continued on page 83)

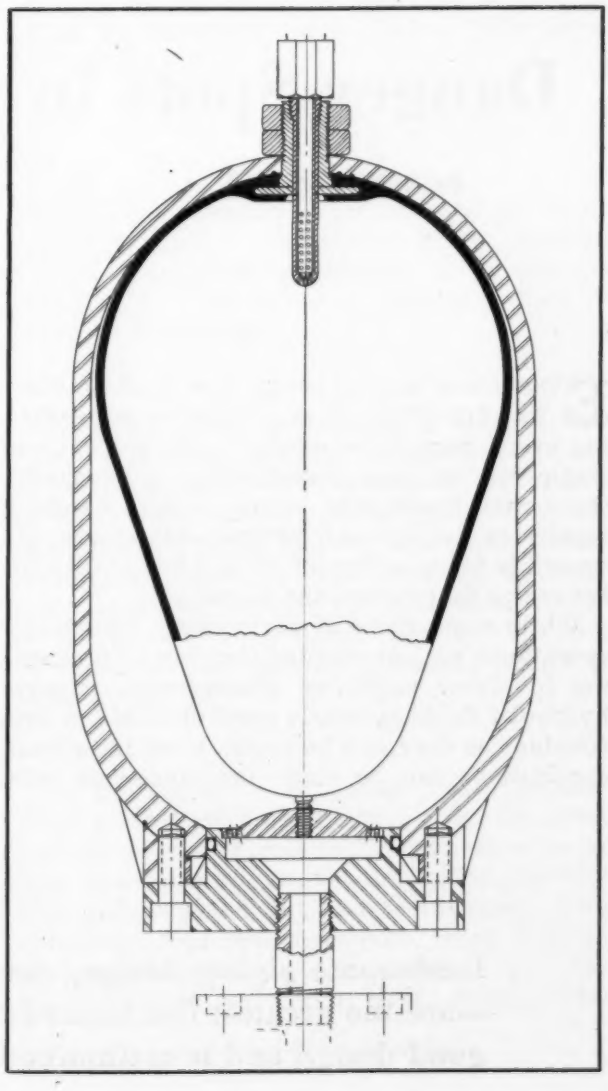
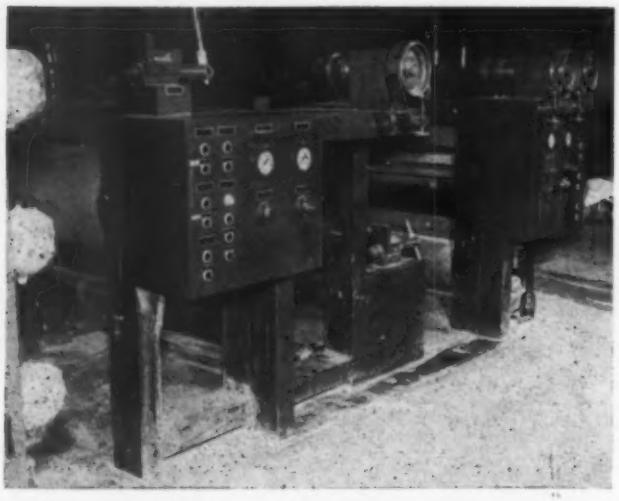
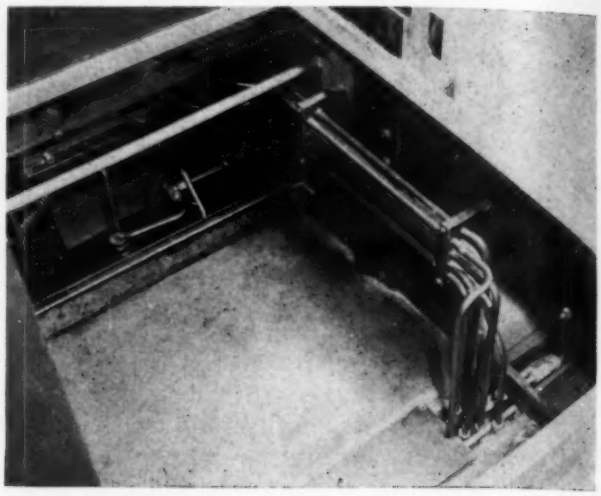


Fig. 5. The accumulator and air piloted hydraulic valve. The accumulator top port has been modified for the use of water; a safety cap has been substituted for the poppet valve in the bottom oil port to permit oil to drain to tank as the bladder fills with water.

A Photo Study: Designing For Safety



CONTROL DESIGN: All adjustment valves have been fully enclosed and piping is carried through rectangular race-ways to a floor trench. Electric and hydraulic controls have been enclosed in the same panel, separated by a wall.



PIPING ASSEMBLY: Closeup of the piping under the operator's platform. The piping layout is neat and simple; using steel tubing with a minimum number of fittings. Pipes are fitted without being strained into position. Strong bracing supplies rigidity.

Danger Spots in Hydraulic Circuits

By RANSOM TYLER

EVEN ONCE IS TOO OFTEN FOR A HYDRAULIC line fire. There is no excuse for not exerting every reasonable effort to prevent even a single fire. A close investigation will usually show that inadequate piping design, careless repairs or neglect—all preventable—were responsible for mixtures of oil and fire or oil and hot metal that caused the trouble.

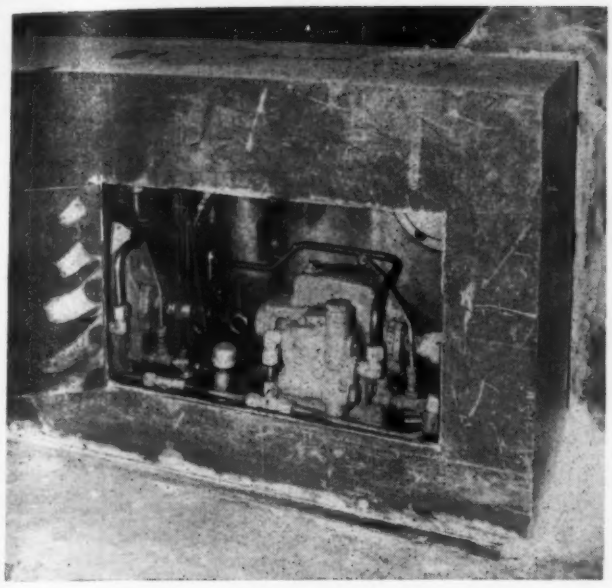
While some types of particularly dangerous operations, e.g., die casting, forging or processing involving explosive atmospheres, require hydraulic fluids as nearly nonflammable or fire resistant as they can be made, most industrial applications can be made insurance-rate safe by proper design, prompt intelligent attention and good workmanship.

First, all possible precautions can be taken to see that oil in the system is kept in the system. A fire hazard can be created only when the oil leaks or is exposed to air and to some means of ignition. A thorough inspection of all hydraulic equipment with this idea in mind will go far towards eliminating hazards.

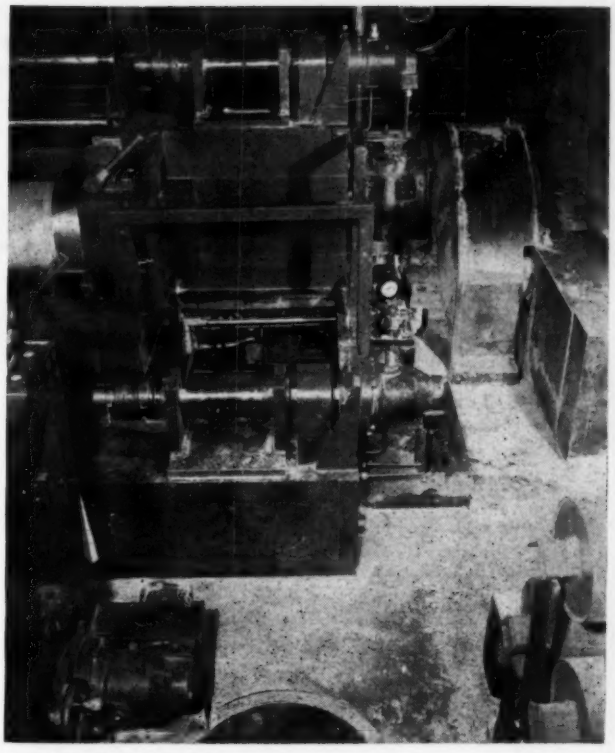
Danger Spots in Hydraulic Circuits

1. **Loose, vibrating pipes are a hazard.** Such lines are almost sure to break due to work

Inadequate piping design, careless repairs and neglect---all preventable ---are the greatest fire hazards in hydraulic circuits. Safety begins with good design and is maintained with good workmanship.



PUMP UNIT: A full enclosure prevents contamination from dirt as well as keeping any leakage away from the work area. The large access door gives ample room for servicing. Much of the auxiliary valving is built integral with the power unit to simplify external piping.



DRIVE MOUNTING: Exposed oil lines to the hydraulic drive motors are kept very short. Flange mounting the motors to rugged welded frames eliminates any vibration. The design is clean and rigid, avoiding exposed, fragile piping and eliminating contamination from outside dirt.

hardening of the metal. Lines with tight joints, well protected against vibration by secure clamps or blocks are safe lines.

2. **Exposed, small, fragile lines invite danger.** Whenever such lines are located where they can be walked on, run over or used as a ladder, they should be moved or protected by adequate guards.

3. **Flexible hose in dangerous areas** is questionable, since it is subject to sudden failure by rupture of walls or by blowing out from its coupling. When design makes it necessary to use hose, the hose should be enclosed in a box or shroud vented to the sump. Often, telescoping or rotary joints or two or more unions can be substituted in dangerous areas.

4. **Long overhead runs should be avoided.** Any failure in their length will spray a film of oil over a wide area, possibly more than one danger area. Oil lines are definitely not "sprinkler" lines.

5. **Partitions and flooring.** Every partition or floor through which hydraulic oil lines pass should be considered a fire wall and all standard precautions observed. Every opening should be closed, preferably with asbestos packing, to seal off fires from one floor or machine to another.

6. **Shock is an indication of malfunction.** Shock is never essential in the operation of any hydraulic circuit. It is introduced by sudden or jerky movements in the operation of valves or controls. Proper valving can usually eliminate shock, often at small expense. If a machine operates as though it were being driven by a hammer or if pipes have a noticeable shock, it is time that the hydraulic circuit be redesigned.

7. **"Emergency" or make-shift repairs.** "Emergency" piping changes only too often include the use of unsuitable materials—malleable iron fittings, wrought or welded pipe in a high pressure oil line. Such fittings and piping should be replaced *right now*. Pipe may be bent or strained in position, either on initial installation or some time later. Such strains

(Concluded on page 90)

Ransom Tyler, hydraulic engineer, The Oilgear Company.

Sheet metal drawer assemblies are turned out at the rate of 290 per hour on this specially built multi-spot welder which cycles at the rate of 376 per hour.

Long Stroke Shuttling Cylinder Reduces Cycle Time

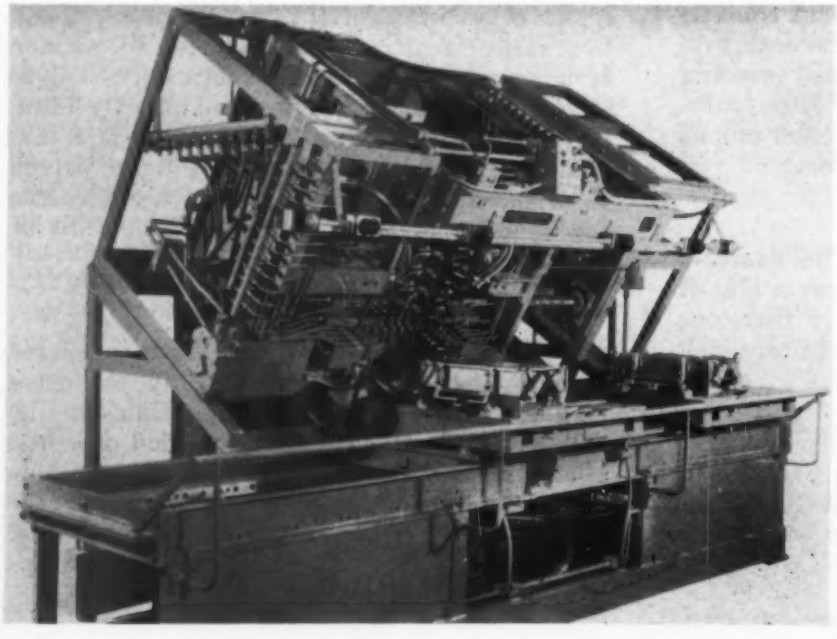
HOME BUILDING HAS BEEN GOING ON AT SUCH a high rate that manufacturers of home fixtures have had to develop many new production methods to keep pace with the demand. To help speed up the output of all-metal cabinet sinks, and to cut down production costs, Precision Welder and Machine Co., Cincinnati, designed and built an automatic multispot welder for the assembly of the sheet metal drawers.

One of the design requirements called for a welder which could be quickly and simply adjusted to handle seven different sizes of drawers. Depth and length remains uniform but width varies from 10 13/16 to 25 13/16 in.

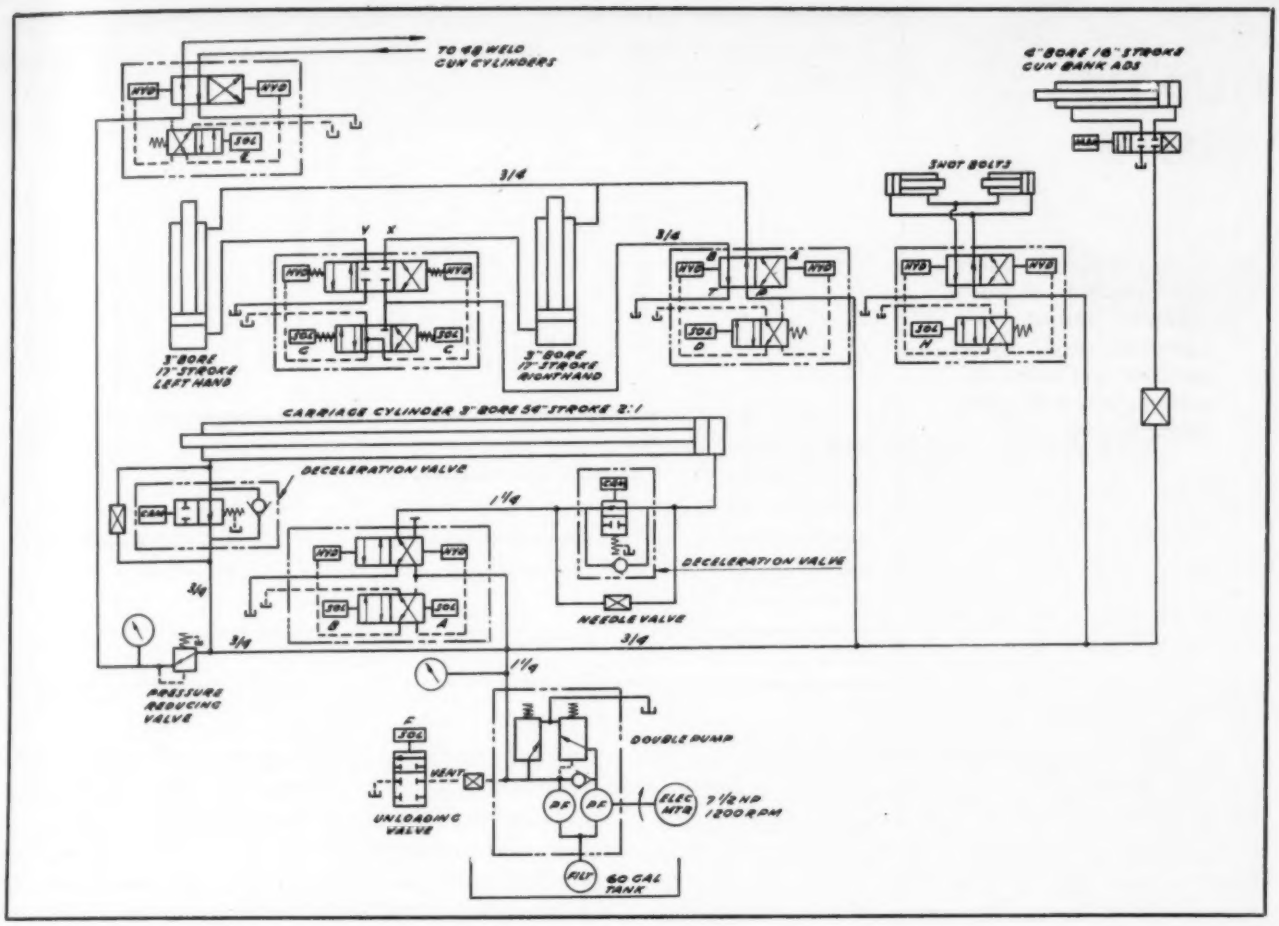
The completed welder has two holding fixtures which are traversed longitudinally on the bed of the machine by a hydraulic carriage cylinder. By using an operator at each end of the machine to load a fixture, there is no unavoidable time delay in loading and unloading due to machine functions. While a drawer in one fixture is being welded, the second fixture is unloaded and loaded. During each cycle, one fixture shuttles from the end load position to center weld position, while the second fixture moves from weld position to end load-unload. Producing 290 drawers per hour means that each fixture is loaded approximately every 25 seconds.

When the fixture moves to the center weld position, the carriage stops and while the end fixture is being loaded and unloaded the center fixture is tilted upward by the action of a lift cylinder.

Once the fixture has been lifted to position in the welder frame, two small, 1½ in dia cylinders move shot bolts to rigidly lock the fixture in welding position. Then the spot weld guns, each actuated by a cylinder, move in to weld the assembly. After welding the guns move out; shot bolts release, fixture low-



The fixture in the center, holding a sheet metal drawer, will be tilted up and locked against the welder frame. After spot weld guns have moved in to weld, the fixture will lower back to the table and move to the left end for unloading and loading. While welding is being done the right hand fixture is loaded and will move to weld position when the finished-drawer is moved to unload. The shuttling carriage is hydraulically powered.



Hydraulic circuit of this spot welder clearly shows the ingenuity of valve selection to properly raise and lower each shuttling fixture.

ers and moves to unload position while at the same time the carriage moves the loaded fixture to weld position. The complete cycle is automatically controlled by limit switches and timing relays which properly actuate the hydraulic control valves. All motions are performed by oil power.

To handle the seven different drawer widths 48 weld guns are mounted to weld the drawer of maximum width. Reduction in drawer width results in fewer spot welds along the back side of the drawer. Globe valves in the pressure lines of the affected welding gun cylinders permit quick shut off of those guns which are not needed for a run of a particular size drawer. As the width of drawer is changed, provision is made to move the bank of guns which are located on one side of the drawer, in or out to the proper locations.

Circuit Design

A two pressure vane pump with built-in high pressure relief valve and built-in unloading valve for the high volume stage, supplies pressure oil from the 60 gallon tank.

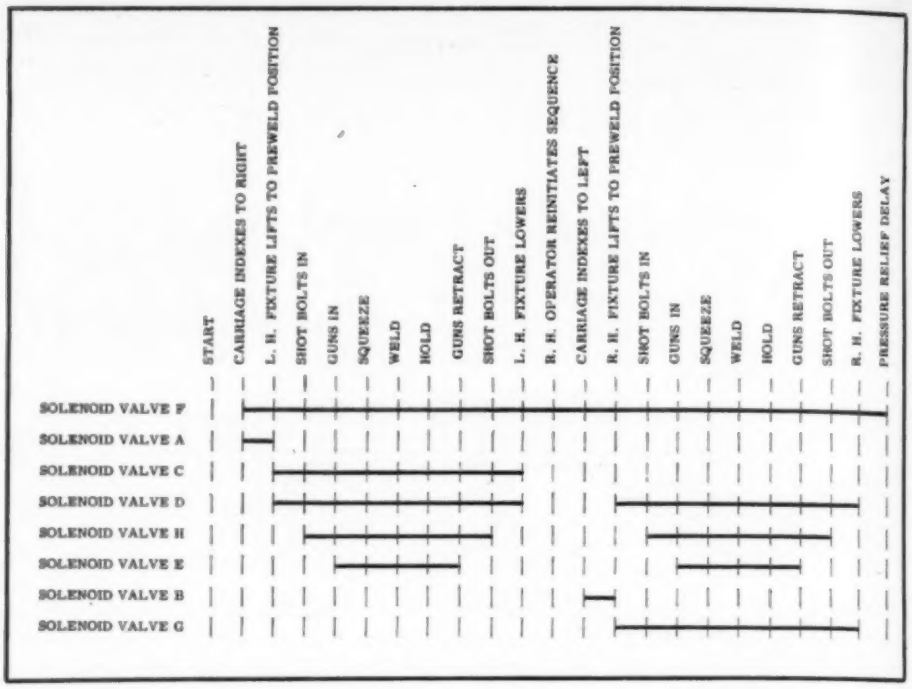
When a limit switch energizes solenoid A, oil is directed to the blank end of the carriage cylinder to traverse one fixture from the right end to weld position and at the same time move the second fixture from weld position to the left end. Full pump capacity of approximately 26 gpm is delivered.

$$\text{Carriage Speed} = \frac{\text{Pump Capacity}}{\text{Blank End Area}}$$

$$\text{or } R = \frac{26 \text{ gpm} \times 231}{3.12 \times 1.5 \times 1.5 \times 60} = 14 \text{ ips}$$

To avoid a heavy impact at the end of each stroke, deceleration valves are placed in both the blank end and rod end lines. Near the end of the stroke to the left, the deceleration valve on the rod end is closed by a cam to trap oil and cushion the stop. The needle valves shown across each of the deceleration valves are open enough to permit a small amount of flow to tank even when the deceleration valves are fully open.

When the right hand fixture is properly located for welding and high volume delivery is no longer needed, built up pressure on the stopped carriage, unloads the high volume side of the pump back to tank through its built-in relief valve.



Timing diagram shows the actuation of each solenoid during one complete cycle. Limit switches and timers are used to maintain automatic cycling.

To lift the right hand fixture, solenoids D and C are energized and pressure oil is directed from P to B to X to the blank end of the right hand lift cylinder. When the fixture has been raised against the frame, solenoid H is energized to move the shot bolts holding the fixture.

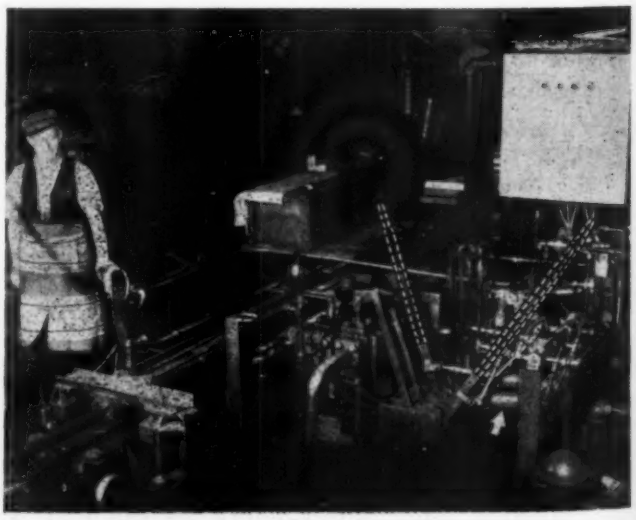
Energizing solenoid B directs oil to the cylinders which move the spot weld guns. The part is welded, guns retract, shot bolts open, solenoids C and D are deenergized so that pressure oil flows from P to A to the rod end of the lift cylinder to lower the fixture. Solenoid A is deenergized and B energized to move the carriage to the right for welding the drawer in the left hand fixture.

Convert Those Hand Levers To Remote Control

BY REPLACING MANUALLY OPERATED LEVERS with electrically controlled compressed air cylinders, The Riverside Metal Company, Riverside, N. J., now operates its scrap metal balers with one man instead of the two formerly required. The change-over will pay for itself in less than ten months.

The illustration shows how the "cabbage" machines were converted to effect this saving. Formerly, to operate the hydraulic rams which compress scrap metal into easily handled bales, the dotted-in levers had to be manipulated manually. This required one man at the loading zone and a second at the levers.

Replacement of the three levers with remote controlled cylinders (arrow) permits one man, from one side of the machine, to load, operate and unload the baler. The result is more than twice as many bales per man-hour, plus liberation of man-hours for use elsewhere in the plant.



Timing the motions of hydraulic cylinders is cause for some serious "head scratching" on the part of the designer and user, to get a machine which is safe and will turn out parts having consistent quality with a minimum of wear to tools and machine parts. Here is how . . .

CIRCUIT HINTS

Two Timers Control Piercing Tools

By RUPERT P. ESSER

TIME REQUIRED FOR PISTON TRAVEL IS A FUNCtion of cylinder diameter and oil delivery. To maintain a constant travel rate on the four cylinders used on this door piercing machine a constant volume pump is used. This five gpm pump delivers oil to the cylinders through a 4-way solenoid controlled, pilot operated valve.

In the neutral position, the directional valve is spring centered with pressure port open to tank permitting the pump to unload to tank at zero pressure during no-work periods; and cylinder ports closed to prevent drifting or creeping of cylinders.

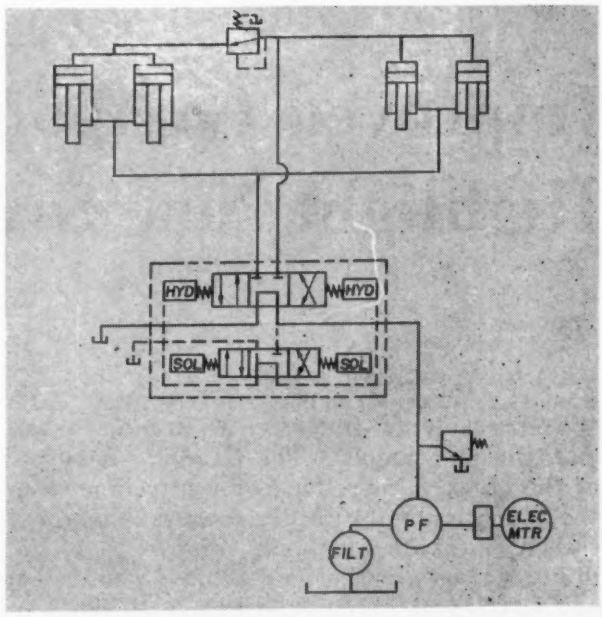
The operator presses the start button energizing timing relay TR-1. Contacts 4-5 close to energize timing relay TR-2, closing contacts 5-2 and 1-7.

Contacts 1-7 energize the forward solenoid on the hydraulic valve to direct oil to the head end of the first pair of 2 in bore piercing cylinders.

The sequence valve keeps the 3 ½ in dia cylinders from moving until the punches driven by the 2 in cylinders complete their work, and pressure builds up to open the sequence valve to direct oil to the head ends of the second pair of piercing cylinders.

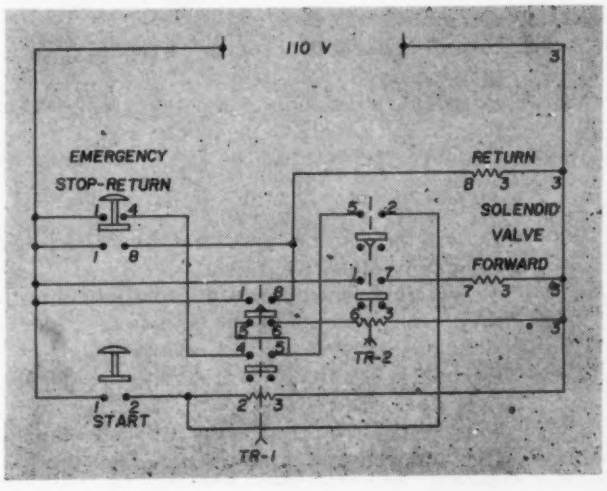
After the work is pierced and TR-1 has timed out, contacts 5-6 open and 1-8 close. This action deenergizes TR-2 to open contacts 1-7. Closing of contacts 1-8 energizes the return solenoid to return the cylinders. After the cylinders have returned and TR-2 has timed out, contacts 5-2 open, causing TR-1 to drop out, opening 4-5 and 1-8, deenergizing the return solenoid and permitting the spring centered 4-way valve to move to neutral unloading the pump.

Rupert P. Esser is chief engineer with TEC Engineering Corp., Logansport, Indiana.



Hydraulic Circuit

Electrical Circuit



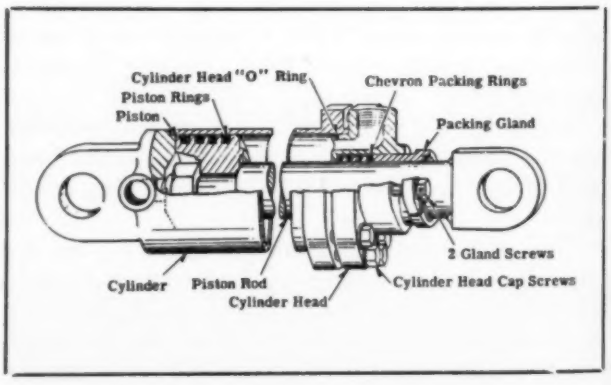
By S. F. WINCHELL

Improved Components Highlight New Gradall Design

EARTH MOVING EQUIPMENT MUST BE VERSATILE and rugged. The Gradall, using one of the quickly interchangeable attachments on the end of its hydraulically powered boom, will trench, excavate, stockpile, remove pavement, grade, act as a crane, and remove snow.

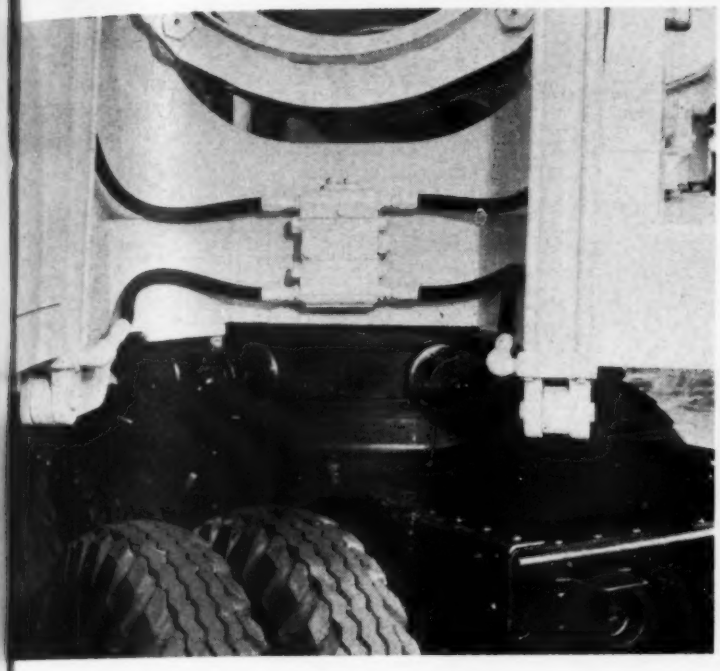
The Gradall, being a new development, has been given careful study for means of simplifying it's construction. Among the important refinements accomplished were:

1. Reduction of the number of hydraulic components.
2. Better accessibility to the hydraulic components for maintenance and adjustment.
3. Positioning of boom hoist cylinders for maximum effective performance.
4. Reduced the number of fittings and amount of hose, which in turn reduced the assembly and service problem.
5. Redesign of cylinders for longer life and easier maintenance.
6. Relocation of hydraulic components to give most practical pipe and hose connections.
7. Greater visibility and convenience to the operator.
8. Increased structural strength for longer life and reduced maintenance.



THIS CROSS SECTION of the boom raise, and lower cylinder assembly, illustrates the design emphasis placed on longer life and simplified maintenance. In all cylinders stuffing box bearing lengths have been increased to give maximum bearing. Rock-hardened duck and neoprene piston rings, are being used with chevrons for hydraulic seal. Welding has been revised to eliminate the possibility of weld scale entering the cylinders. The servicing of these cylinders has been greatly simplified.

S. F. Winchell is chief engineer, of the Warner and Swasey Company, New Philadelphia, Ohio Plant.



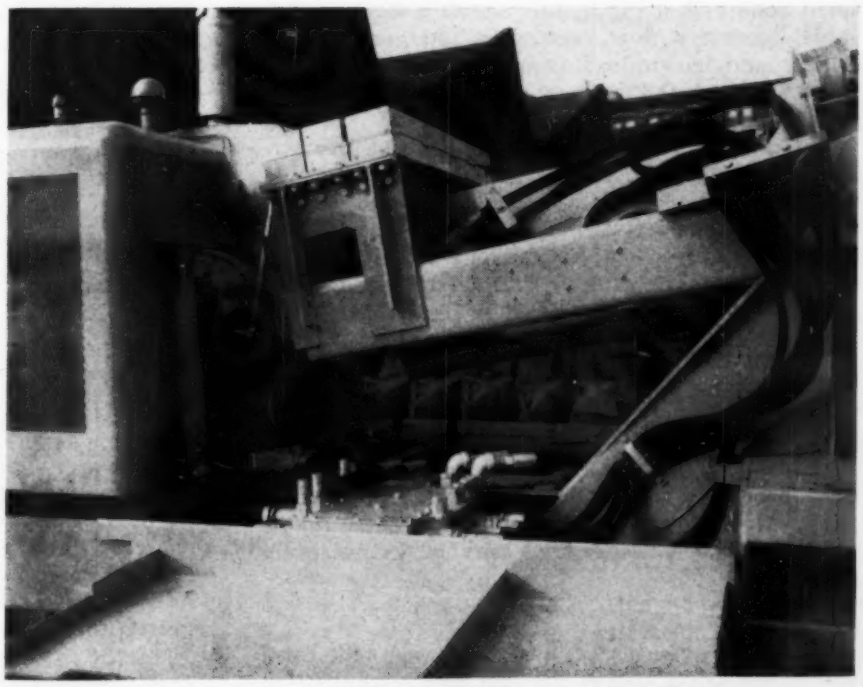
THE HOIST FLOW CONTROL valve is accessibly located between the two hoist cylinders at the front of the machine. Built within the valve housing, is a flow-regulating plunger to control the speed of the boom when it is being lowered; and an unloading plunger which spills off the excess oil encountered in lowering. A fixed orifice in this valve, causes the back pressure which operates the flow regulating plunger, to restrict the rate of drop of the boom. Two of the four pairs of bogie-mounted rollers which provide stability as the machine swings on the roller path are visible.

TWO HOIST CYLINDERS raise and lower the boom. These cylinders, which previously had been located behind the trunnion support and connected to the rear of the boom, are now located ahead of the trunnion support, and operate with a minimum of angular pivoting. By this change, the maximum effort of the cylinder is exerted on the lift of the boom, instead of the down stroke, as was previously the case.

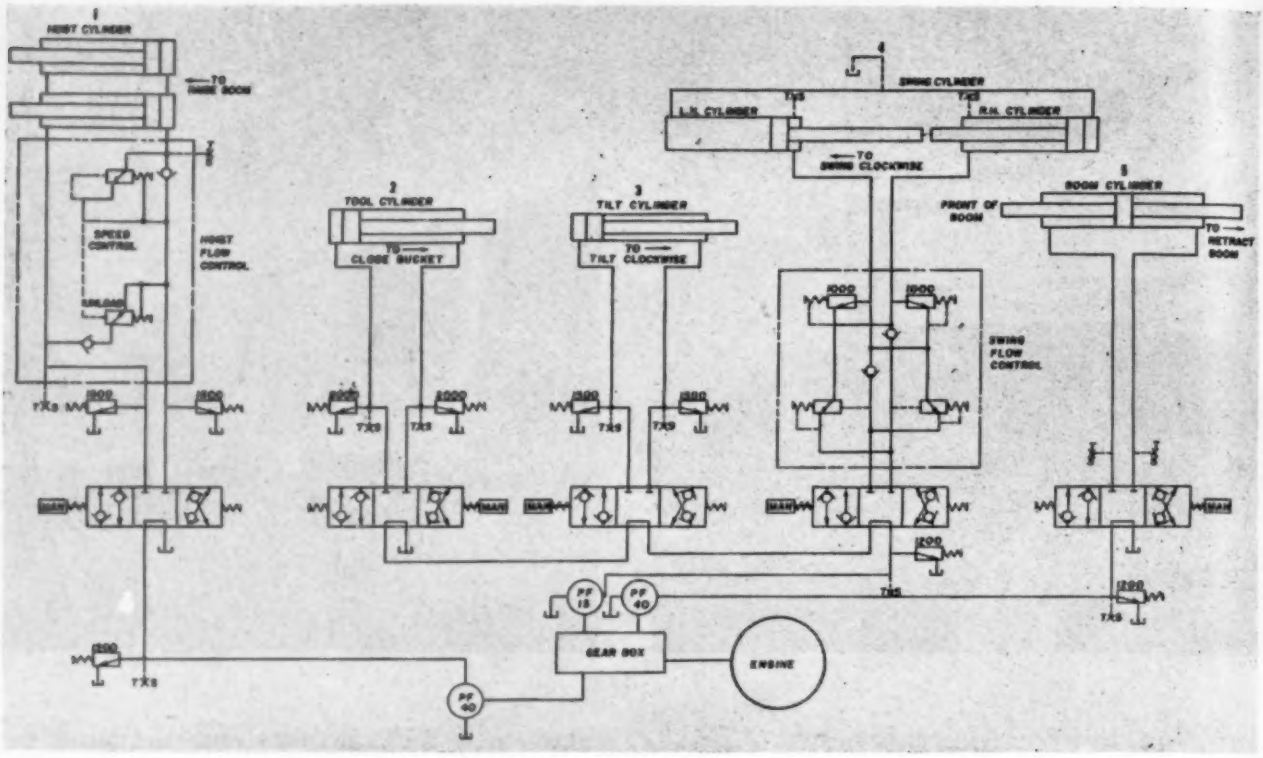
The accompanying photographs and circuit diagram show clearly, the compactness of the power system and indicate how simplification has been accomplished.

TO SIMPLIFY SERVICING, and to permit more visibility in the cab, the valve manifold has been positioned adjacent to the pumps, and the engine. All five directional control valves are attached to the manifold. Seen on the left edge of the manifold are the three differential type pump relief valves; threaded into the top right edge are the six stubbier poppet type hose relief valves. This move has considerably simplified and reduced the amount of piping. Mechanical linkages from the operator's cab easily actuate the directional control valves.

Swing flow control and relief valves are seen mounted to the left of the manifold.



Circuit on next page . . . .



Gradall Uses Unique Hydraulic System

All operating motions are controlled by this hydraulic system, which may be considered as five separate circuits.

1. Boom Hoist. A separate pump powers the boom hoist cylinders. In this circuit a flow control valve, having a flow regulating plunger, a fixed orifice, and an unloading plunger, controls the speed at which the boom is being lowered and bypasses the excess oil to the tank.

Test stations are located throughout the five circuits to facilitate checking the pressure settings of the relief valves and flow control valves. Since proper pressure settings are necessary to maintain the proper power output, convenient test stations readily permit checking of cylinder pressures.

2. Boom Tilt. This single cylinder, mounted at the rear of the boom, has replaced the two cylinders which previously performed the tilt operation. This circuit contains two of the six hose relief valves that are used on this system. These reliefs are in lines where pressure other than that supplied by the pump may be exerted on the lines. These reliefs limit the hose pressure that may be extraneously caused.

3. Tool Actuation. A cylinder located at the front end of the boom moves the tool attachment. Oil is supplied to the swing, tilt, and tool cylinders through control valves connected in series, which means that only one of these operations can be powered at one time.

4. Boom Swing. The roller chain which rotates the machine is fastened between the ends of the two swing cylinder piston rods. As pressure oil enters the rod end of one of the swing cylinders, the roller chain is pulled, causing rotation of the machine. The piston rod of the other cylinder, is pulled out by this action. Rotation in the opposite direction, is obtained by admitting oil to the rod end of the other cylinder, which causes a reverse action on the machine.

An interesting flow valve has been designed to act as a brake to prevent the machine from rotating faster than the cylinder travels. This valve also keeps the total volume of the oil in the two cylinders constant.

5. Boom In-Out. Positioning the four way control valve moves the boom cylinder in and out. Oil is supplied from a 40 gpm pump. Each of the five control valves are identical. In their neutral position, the pump delivery returns to the tank under no load, and cylinder ports are blocked. Checks are built into the circuit to prevent reversal of oil flow when the cylinder pressure exceeds the pump pressure. The control valves can be infinitely positioned to regulate the rate of movement.

Factors Affecting "O" Ring Life

Gland Design
Type of Compound
Lubrication of Seal
Operating Temperature
Metal Hardness; Surface Finish

"Floating" Gland Design For Long "O" Ring Life

By **TOMMY J. McCUISTION**

TEARING DOWN A VALVE OR CYLINDER TO REplace the packing is perhaps the most consistent maintenance problem confronting the user of air and oil components. He expects packing wear, but he keeps looking for the packing which will make it difficult to remember when the packing was last changed.

While the effects of most factors influencing "O" ring wear are well known, and new compounds are continually being developed to best meet specific service conditions, the actual design of the gland warrants considerable investigation.

Tommy J. McCuistion is Cleveland Branch Manager of Precision Rubber Products Corporation, Dayton, Ohio.

The "floating" gland design shown here is the result of study aimed toward increasing packing life. The design presents an entirely new size relationship of piston grooves and cylinder bores to packing sizes. Previous theories of what was considered to be optimum "squeeze" do not apply.

In developing this gland, we first had to understand what happens to an "O" ring when under high pressure. Figure 1 shows the "O" ring cross-section under pressure. At higher pressures it seems that the seal tries to plug the opening opposite the pressure and distribute itself almost equally on both sides of the radial clearance. In view of this it was decided that squeeze may be only necessary at low pressures.

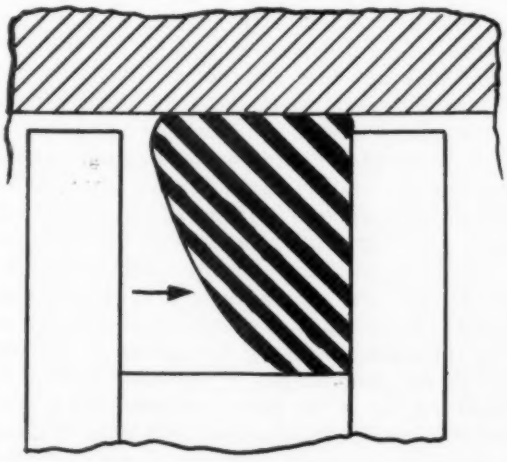


Fig. 1. Under pressure the "O" ring tries to plug the opening opposite the pressure and distribute itself almost equally on both sides of the radial clearance.

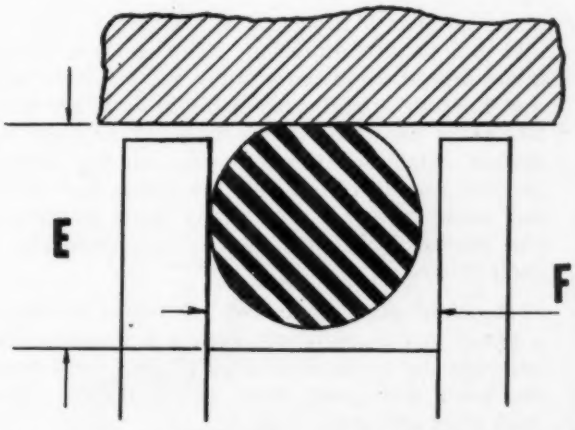


Fig. 2. Design of this floating gland piston seal calls for "O" ring o.d. 5 to 8 percent larger than bore diameter. Groove width F and depth E are made 10 percent larger than the "O" ring diameter plus ring tolerance.

The problem was reduced to:

1. Establish a squeeze or load to seal at static or no pressure condition.
2. Increase the interference between the seal and the moving surface opposite the groove without increasing diametral squeeze and frictional resistance.

The loading should be only enough to effect a seal at low pressures. It should be constantly applied. If possible it was desirable to stay away from spring loaded gland designs due to the expense and space involved. If the loading could be reduced to a minimum without reducing the amount the seal would wear on its cross section friction problems would also disappear.

On air valves it was found that the "O" rings tended to wear rapidly until only about .001 to .002 inch squeeze remained. From this point on, the ring continued to seal satisfactorily, yet, it hardly seemed to wear at all if properly lubricated. This tends to bring out the fact that a great deal of the wear on the "O" rings used in a conventional manner is caused by the squeeze of the gland.

The "floating" design uses an "O" ring having an inside diameter larger than the root diameter of the groove—the ring is never squeezed between the bottom of the groove and the opposite moving cylinder wall. To give a radial squeeze, the cylinder bore is made 5 to 8 per cent less than the "O" ring o.d.

In gland design for a rod application the "O" ring i.d. is 4 to 6 per cent less than the rod diameter meaning that the ring must be

(Concluded on page 90)

Application of "Floating" Gland

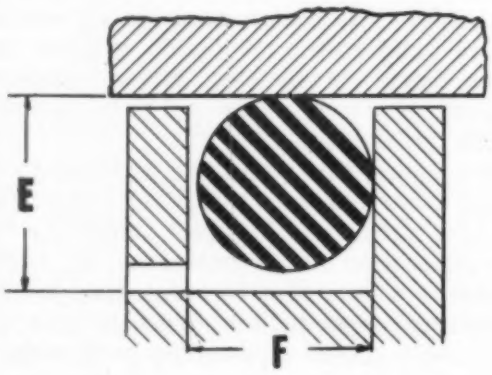


Fig. 3. Valving design.

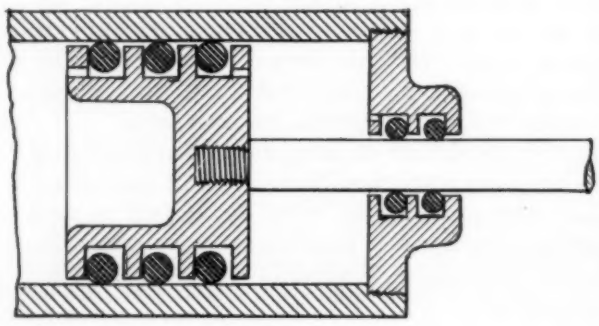
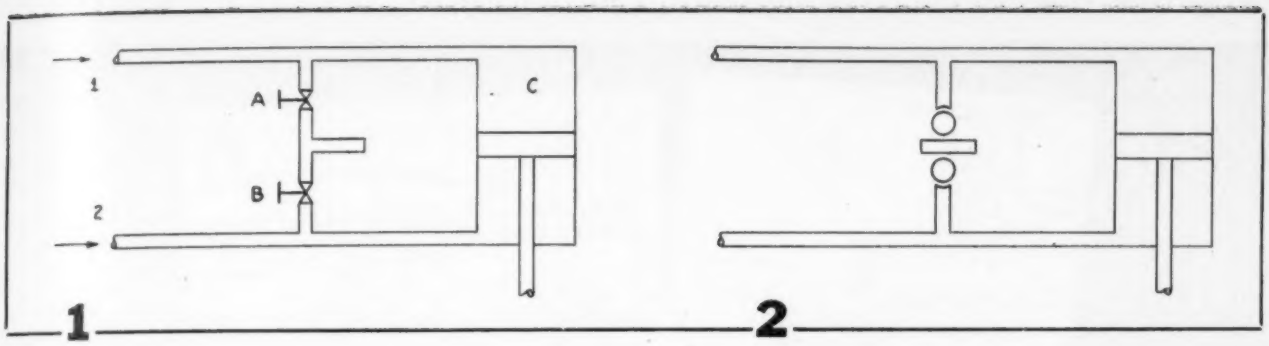


Fig. 4. Combination design.

The "floating" gland design opens up the possibility of using more than one "O" ring in a gland so that a progressive wearing out of the seal can be accomplished. The rod and piston gland design combines a fairly old principle with the "floating" gland. All of the grooves are made like those described in Figure 2 except holes are drilled into the pressure side of the outside grooves on the piston and the inside one of the rod packing gland. As many seals as desired can be used by carrying out this principle in each groove.

If, on the other hand, two "O" rings are put in a gland in conventional grooves a pressure lock between the seals usually develops. As a result the seals wear out much faster than a gland with only one seal.

A "floating" "O" ring groove with one or more holes in the side, at the bottom of the groove, will act almost identical to a cup, lip or similar type seal. It will seal in one direction only. Fluid will flow fairly freely even at very low pressures when pressure is applied to the side of the gland opposite the holes. We will call this type a "valving gland". By combining a "valving gland" with a "floating" gland it is possible to make a gland that will progressively wear out each seal in order. Since there is no cross-sectional squeeze on any of the "O" rings there is very little wear on any of the seals except when the pressure is on that particular seal. After the first seal wears out the next one takes over the job of sealing. Additional lubrication can be provided between the seals if desired. This type of gland makes it possible to not only increase the life of the gland but provides a safety factor as well. In addition, this type of gland does not have as much friction as one "O" ring in a conventional groove.



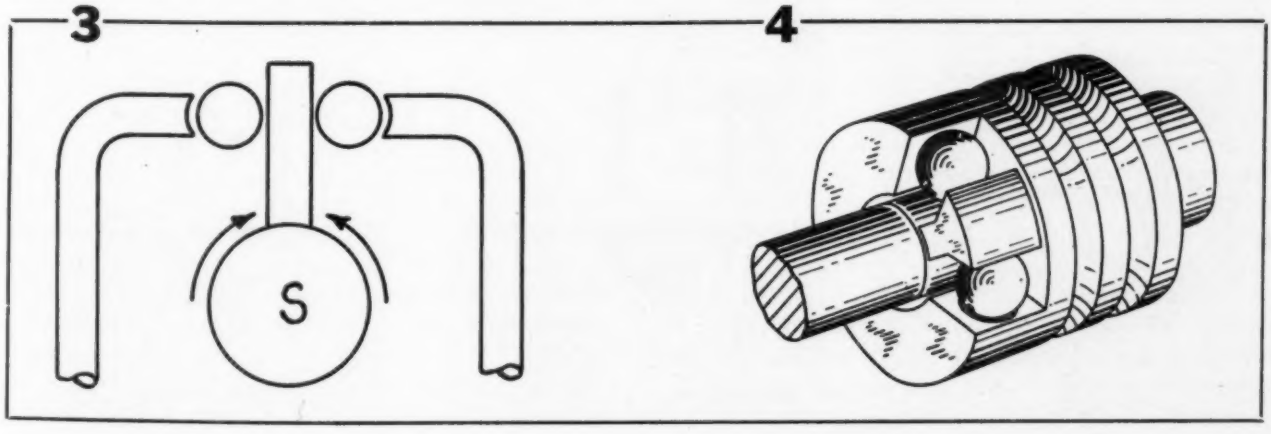
Unique Valve Assembly For Automotive Steering

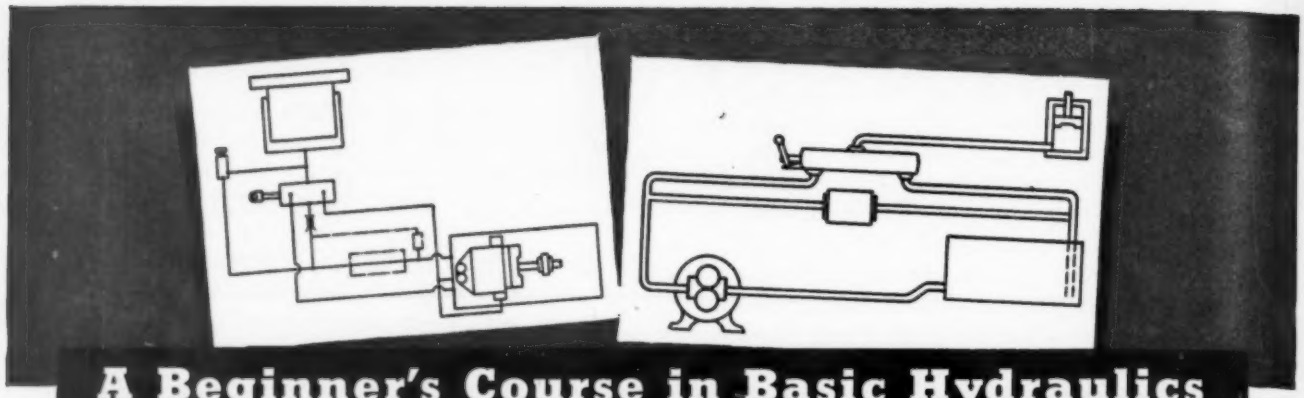
A departure from hydraulic steering mechanisms employing spool type valves is the Shallcross bleeder system (patents pending).

The principle of this system is illustrated schematically in Figure 1. Separate and independent oil sources are introduced at 1 and 2 and are free to flow through valves A and B. Shutting off, for example, valve A will cause pressure to rise in chamber C and the piston to move downward; conversely shutting off valve B will move the piston upward. Various rates of movement and various values of piston force can be obtained by adjusting valves A and B.

Figure 2 shows the bleeder system of Figure 1 modified for a steering gear. Valves A and B have been replaced by balls and ball seats and a control blade has been introduced between them. This control blade is mounted on the steering shaft S, as shown in Figure 3. Rotation of the steering shaft will press either ball into its seat and bring about aid to the driver via a cylinder attached to the steering links.

In actual practice the balls and the ball seats are arranged on a cylindrical member as shown in Fig. 4 which rotates in a housing and is attached to the steering gear shaft. Hydraulic fluid is brought to the ball seats via grooves on the surface of the cylindrical member and axially drilled passages. The piping and linkage are so arranged that, whenever a ball is pressed into its seat the hydraulic cylinder assisting will, while directing the vehicle's front wheels, rotate the cylindrical member away from the respective ball and return the hydraulic system to neutral.





A Beginner's Course in Basic Hydraulics

Chapter VIII

HYDRAULIC PUMPS

Part 9

Combination Pumps

PRESSURE OIL PERFORMS TWO OR MORE FUNCtions on so many industrial machines, that manufacturers of hydraulic pumps have found it practical to bring out a standard line of combination pumps. The use of these pumps greatly simplifies circuit piping and offers a compact power package.

In this discussion of combination pumps we are including two-stage pumps, tandem pumps, duplex and feed pumps—the terminology is determined in part by the application but mostly by the manufacturer's choice.

When two positive displacement pump units are combined in one housing, we have a combination pump. By building into the pump suitable valving and ports, a number of output combinations may be realized to fit specific circuits. An analysis of these combinations will best describe their operation, construction and application.

Two stage pump—Two identical vane type pumps are mounted on the same shaft in the schematic, Figure 1. These pumps function in series. The advantage of this design is to offer double the pressure which is obtainable by using only one pump. Since most present day

Fig. 1. Two Stage Pump

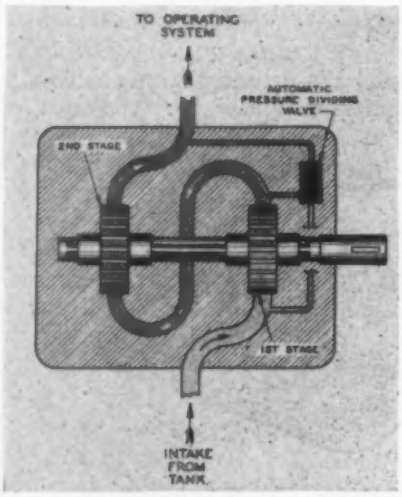


Fig. 2. Duplex Pump

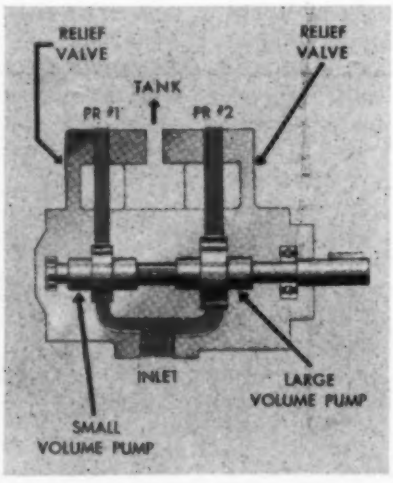
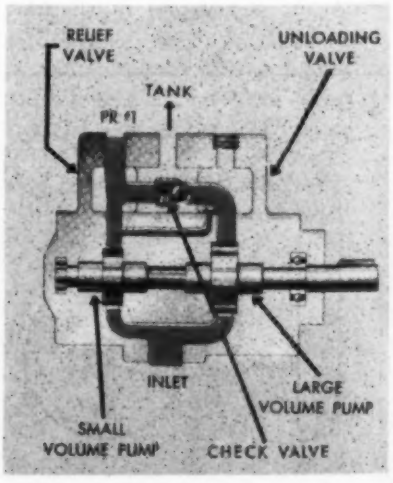


Fig. 3. Two Pressure Pump



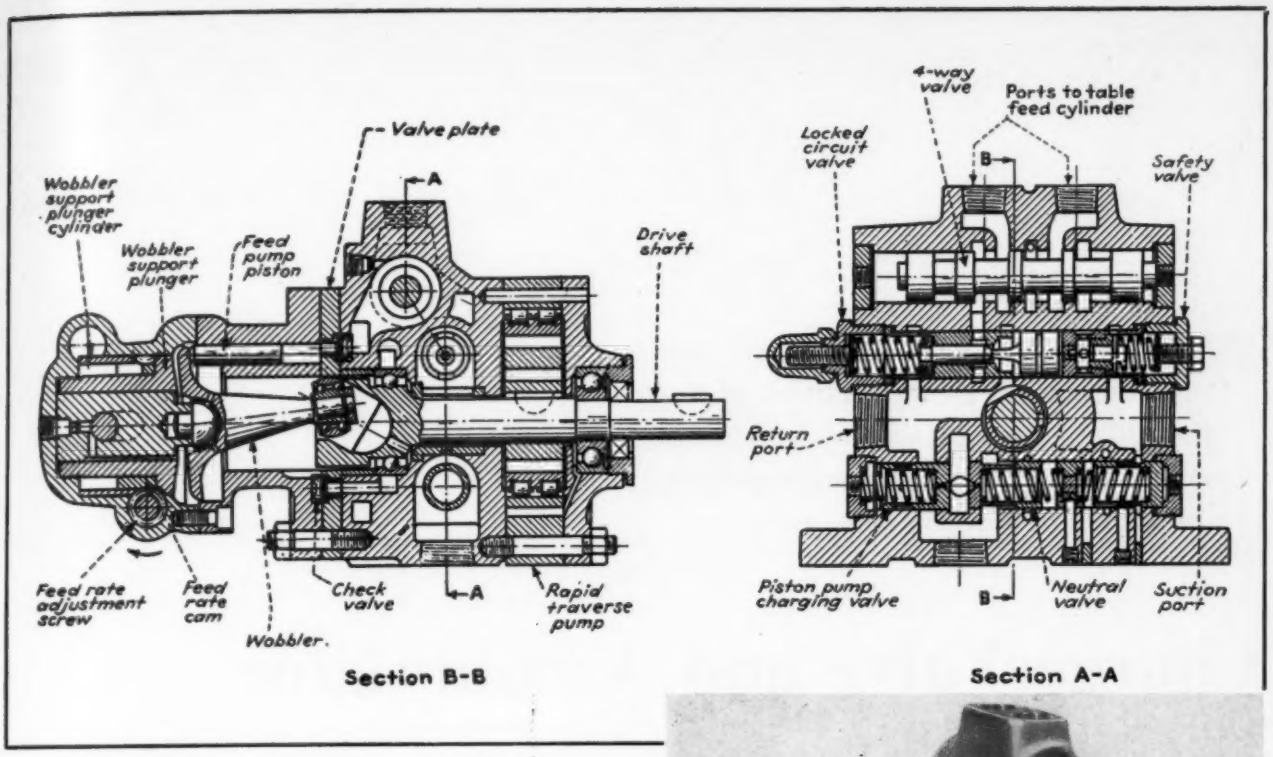
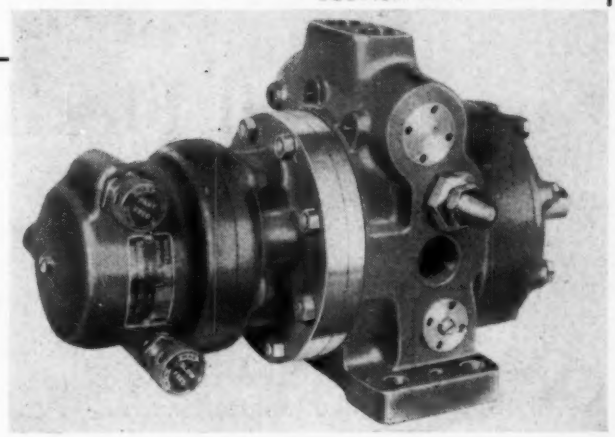


Fig. 4. Feed Pump

Courtesy Sunstrand Machine Tool Co.



designs of gear and vane pumps operate at maximum efficiency at approximately 1000 psi, systems requiring higher pressures may economically be supplied by the use of a two-stage pump.

The key to the operation of this pump is the pressure dividing valve which is a differential type relief valve. This valve distributes the hydraulic pressure load between the two pumping units, and protects the second pump in case the first pump should stop pumping. If it were not for the differential valve the first pump would carry the entire pressure load—and rapidly breakdown. To protect the first pump if the second should fail, a relief valve is placed between the two pumps. An external high pressure relief valve is used to protect the entire pump.

Two pumps in series permit doubling pressure load; there is no gain in capacity, oil delivery remains equal to the capacity of one pump.

Duplex pump—Two separate pressure and delivery ports are available in the pump arrangement shown in Figure 2. Here the small and large volume pumps are driven by a standard single end motor and otherwise operate independently. Built-in relief valves protect each pump. This combination is used to operate separate circuits while providing the convenience and economy of a single compact pump.

Two pressure pump—Many press and machine feed applications call for rapid traverse followed by slow feed or squeeze and then a rapid return of the work piece or tools. Such applications dictate the need for large volume low pressure oil delivery for rapid movement and then low volume high pressure for the squeeze or feed. The combination pump shown schematically in Figure 3 suits these applications. Here the deliveries of both pumps are combined at one outlet. Built-in valving controls the operation. For rapid traverse the volume of both pumps is delivered at a low pressure. When the work is encountered, pressure builds up to unload the large volume pump back to tank, and then feeding takes place by the action of high pressure oil from the small volume pump. The large volume pump may also be unloaded by the action of a limit switch which is tripped near the end of the rapid stroke to actuate a solenoid operated unloading valve.

Two pressure and duplex pump—The pump shown schematically in Figure 3 can also be used as a duplex pump by removing the plug

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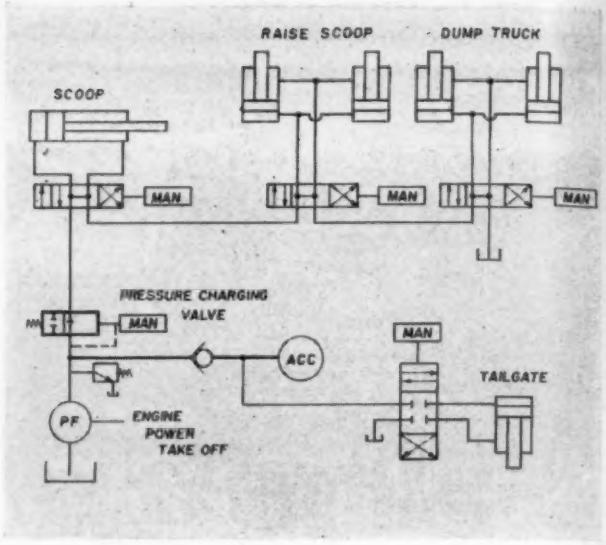

If you are using an open center system which requires the addition of another utility, here's a method which will make the changeover at a low cost with a minimum of new components.

Charge Valve and Accumulator Give Circuit Flexibility

OPEN CENTER HYDRAULIC SYSTEMS ON AGRICULTURAL and road building machinery are often selected as a compromise with cost. Their use eliminates the need for a costly unloading valve as the pump delivery is directed back to tank through the open center valves when the system is in neutral.

However, when a number of utilities are controlled by 4-way, three position valves piped in series as shown in the circuit drawing, the open center system has a serious disadvantage—operations must be independent of each other because only one function at a time may be actuated.

The circuit shown here is a simple power system for a dump truck having a scoop shovel mounted to the front end. One cylinder actuates a scoop to pick up the load; the pair of lift cylinders raise the scoop up and over the cab to the truck body. The scoop cylinder is again actuated to drop the load into the body. For unloading, the dump cylinders are actuated to raise the truck body. None of these functions must be done at the same time.

It was found desirable to add a function to the system. Opening the tailgate must take place sometime during the lifting of the truck body. Two actions must be done at the same

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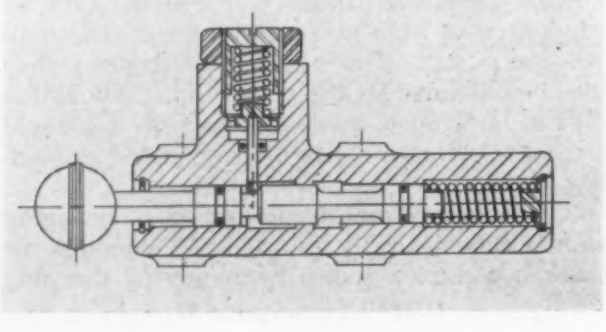

Pressure Charging Valve—Pushing in the plunger blocks the ports to allow pressure to develop in the circuit above the valve. When pressure builds up to the valve setting the spool shifts to bypass oil through the valve. Used here to charge an accumulator, the valve may also be applied as a simple means of unloading a system or as a manually set sequence valve.

Courtesy Greer Hydraulics Inc.

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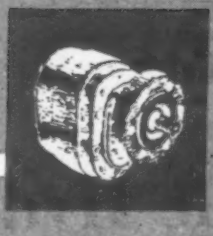
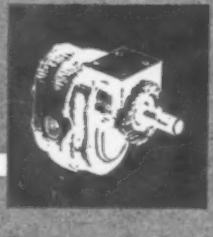


PUMPS



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Advisory Editor

A Progress Report:

Nonflammable Hydraulic Fluids

By FRED O. HOSTERMAN

Important work on the development of nonflammable or fire resistant hydraulic fluids was begun during World War II when the Military Services took cognizance of the part which hydraulic fluids might have in the fires resulting from battle damage. This work was chiefly sponsored by the Military Services and was largely accomplished in their own development laboratories. Shortly after the end of the war, additional work was begun by some of the major aircraft companies and by private industry. This additional work was given extra impetus when several fires in commercial aircraft were either attributed to or augmented by hydraulic fluids. While there have been many discussions relative to the importance of hydraulic fluids in the over-all problem of aircraft fires, all have acknowledged that this was the one flammable fluid which might easiest be eliminated from the aircraft, and so the development proceeded.

Table 1—Flammability

SPECIFICATION NAME MANUFACTURER	AMS-3150 HS-1 U. B. BRAY CO. LOS ANGELES	MIL-O-5606 (AN-O-366)
BASE	(UN RESTRICTED) (1)	HYDROCARBON
CHARACTERISTICS: AUTOGENOUS IGNITION TEMPERATURE (2)	750° F	470° F
HIGH TEMPERATURE IGNITION (4)	FLASHES WITH DIFFICULTY	VLF (5)
SPRAY-GUN-LOW PRESSURE IGNITION (4)	NO INCREASE	FIRE INCREASES
HOT MANIFOLD TEST (4) (a) 1300° F	BURNS ON PIPE	FIRE ON PIPE AND PAN
(b) ACTUAL IGNITION TEMPERATURE	1150° F	1050° F
EXPLOSION TEST (6) INCENDIARY FIRING (.30 CALIBER)	N. D.	FIRE

Fred O. Hosterman is chief sales engineer with Weston Hydraulics, Ltd., North Hollywood, Calif.

THE EARLIEST INVESTIGATION CENTERED around an analysis of currently available materials or groups of materials which might possess the necessary characteristics of a good hydraulci fluid and yet be greatly more resistant to ignition and burning than the mineral base fluids then in universal use. It was recognized that any material found to be suitable as a base stock would probably require the addition of other materials in order to make up for any deficiencies in the base material.

Most of these early searches for base stocks arrived at approximately the same group of possible materials, although some of the searchers differed in the opinion as to which offered the greatest promise. The most important classes of materials were: (1) Water-glycol base, (2) Phosphate esters, (3) Silicones, and (4) Halogenated compounds. During the ensuing years, much work was expended toward the development of each of these classes and to a large extent these classes remain today among the outstanding possibilities for an ultimate solution, although additional families are continually being investigated.

In each of the above listed material classes, some actual test fluids were prepared and it may be interesting to make a brief review of the most important developments in each of these classifications.

Water Base Fluids

Some of the earliest developments, particularly those carried on by the Naval Research Laboratory, were concentrated on a base stock consisting of water, plus ethylene glycol, together with a water soluble polymer to act as a thickening agent and other additives to improve lubrication and inhibit corrosion. This approach was chosen by this group since they felt that it offered a suitable solution to the problem and at the same time offered a fluid which could be used with the packings, hose, and other similar materials then being used in service aircraft.

The first in this family to reach widespread use was known as Hydrolube U-4, and was the result of a cooperative development by the Naval Research Laboratory and the Carbide and Carbon Chemicals Corporation. This fluid was subjected to extensive laboratory and flight testing and was actually used in at least two production types of Naval aircraft for several years. This fluid represented a considerable amount of progress toward the ultimate goal, but still left much to be desired. Its chief deficiencies were: (1) Marginal lubrication qualities for aircraft pumps, (2) Too great a viscosity at low temperatures, (3) Corrosion difficulties, particularly with magnesium and cadmium plating, and (4) A severe limitation on the upper operating temperature — approximately 140°F.

A more recent development in this field achieved through the joint efforts of the Bureau of Aeronautics and the R. M. Hollingshead Company is that of Hydrolube H-2. This fluid is similar in nature to that of the U-4 fluid but employs different thickening agents and addi-

Characteristics of Hydraulic Fluids

AC-3580 D HYDROCARBON	50743-R RPM-NON FLAMM STAND. OIL OF CALIFORNIA HALOGENATED HYDROCARBON	DMX-8 SKYDROL MONSANTO CHEM. PHOSPHATE ESTER	H-2 HYDROLUBE HOLLINGSHEAD CORP. WATER-GLYCOL	U-4 HYDROLUBE CARBIDE CARBON CHEMICAL CO. WATER-GLYCOL	9981-LT-25 SILICONE GENERAL ELECTRIC CO. SILICONE OIL	REFERENCE
495° F	980° F	1050° F	N.D. (3)	N.D.	N.D.	(1) Reference fluid for flammability tests only. Subject to continued development.
VLF	NO FIRE	FLASHES WITH DIFFICULTY	NO FIRE	NO FIRE	FLASHES READILY	(2) ASTM method D286-30
FIRE INCREASES	FIRE DECREASES	NO INCREASE	FIRE DECREASES	FIRE DECREASES	FIRE DECREASES	(3) N.D. No Data
FIRE ON PIPE AND PAN N.D.	NO FIRE SPUTTERS AT 1450° F	NO FIRE 1430° F	ACTUAL FLUID DOES NOT BURN. BURNS READILY AFTER WATER HAS EVAPORATED.		BURNS COMPLETELY ON PIPE	(4) Method Spec. AMS-3150
FIRE	NO FIRE	NO FIRE	NO FIRE	NO FIRE	FIRE	(5) V.L.F. Very Large Fire (6) Air Force Test Method

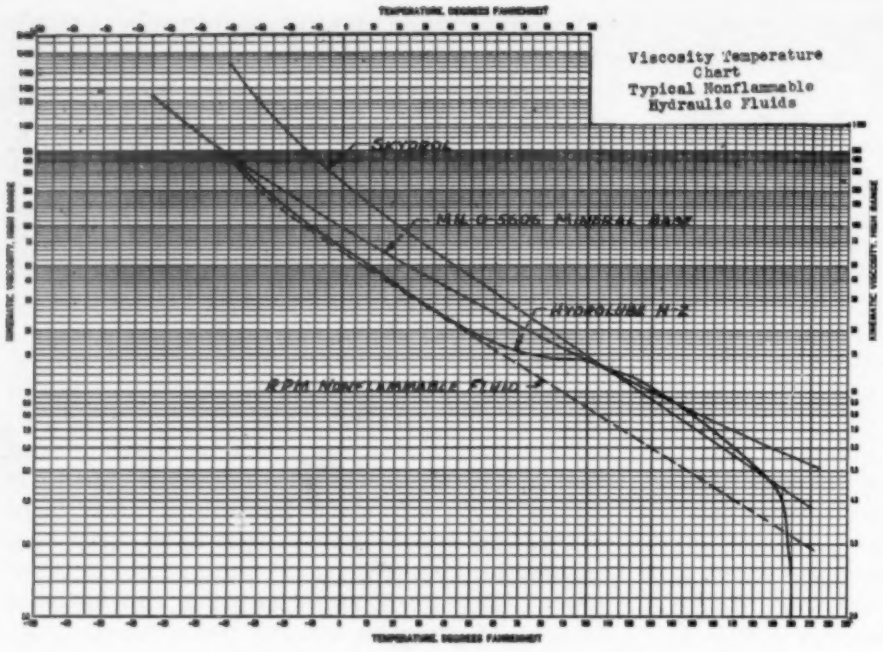

Fig.1. Viscosity variation with temperature is plotted for typical nonflammable hydraulic fluids..

tives. This fluid ostensibly eliminates the chief difficulties encountered with the U-4 fluid, in that it should provide for operation through a temperature range of —60 to +160F and is greatly improved from the corrosion standpoint. It also appears to be much better from the standpoint of pump lubrication.

Hydrolube H-2 has been service tested in Navy aircraft for upwards of 650 flight hours over a period in excess of one year and is said to have operated satisfactorily. The Navy has now placed sufficient confidence in this fluid to begin negotiations for its use in the hydraulic systems of all Navy aircraft, replacing both U-4 and the mineral base fluids formerly used.

Additional developments to improve further the characteristics of the Hydrolube fluids are also being sponsored by the Bureau of Aeronautics. Chief among these aims are the further extension of the allowable temperature range and improvement of the corrosion inhibiting characteristics.

Phosphate Esters

This family of compounds interested many research groups primarily because of the superior lubricating qualities extending into the extreme pressure range, and the good fire resistance which could be obtained. Moreover, since these fluids are essentially nonvolatile, the fire resistance is not affected by evaporation. Many of the compounds leave much to be desired in viscosity at low temperatures, but much study has indicated that considerable improvement can be obtained.

Notable among the developments in this field has been that of Skydrol, a product developed jointly by Douglas Aircraft Company and Monsanto Chemical Company. This fluid has been undergoing service testing for several years and is now being used in some models of commercial aircraft. Because of its superior lubricating qualities, it was first used in the drive system of a cabin supercharger, and later tested and used in the complete hydraulic system of the Douglas Super DC-3 and DC-6. In general, reports to date indicate that the fluid is reported to be operating satisfactorily.

The chief objections to Skydrol have been the rather poor low temperature characteristics plus the fact that it requires the use of new rubber compounds for packings, hose, and similar uses. Most of the service difficulties reported to date have been concerned with these new rubber materials and probably much additional development will be necessary before they are entirely satisfactory.

Silicones

When the problem of nonflammable fluids was first investigated, silicones were among the first of the base materials to be surveyed. Actually, while the silicone fluids are often difficult to ignite, they are far from nonflammable and frequently can be made to explode quite violently. It was also found that the steel on steel lubricating qualities left much to be desired. In addition, there was the problem of compounding a suitable seal material since the silicone fluids would shrink most of the synthetic rubber which might otherwise have been satisfactory. This problem, however, was probably the least serious and it was the combination of the above deficiencies that

Another PESCO FIRST...the Unloading Gear Pump ...flies with SAAB at transonic speeds

Lighter weight . . . longer service life . . . lower maintenance expense . . . smaller initial cost . . . four good reasons why Pesco's new unloading gear-type hydraulic pump is rapidly replacing conventional variable volume pumps on aircraft . . . particularly jets.

Among the first to take advantage of the many benefits of Pesco's latest contribution to more efficient, more dependable aircraft operation is the famous Swedish SAAB Aircraft Company. Its new SAAB-29, designed to fly at speeds up to the transonic speed range, depends on the Pesco Unloading Gear Pump for all hydraulic operations including landing gear, wing flap, brake operation, etc.

Always alert to the demands of aircraft makers for reductions in weight, elimination of service and maintenance problems, and lower costs, Pesco research engineers are continually searching for ways to improve present equipment as well as develop new products to meet these important requirements.

It is this constant research that keeps Pesco aviation products standard equipment on military and commercial aircraft. If you have a problem in aircraft hydraulics or fuel handling, perhaps this experience can help you. A Pesco engineer will gladly discuss your problem with you . . . without obligation, of course.

Pesco Model 011799 Unloading Gear Pump. Weight 8.6 lbs. Maximum continuous operating pressure 1500 p.s.i. Capacity 2 g.p.m. at 1500 r.p.m. Features Pesco's exclusive, patented "Pressure Loading" principle. Other models available for pressures to 3000 p.s.i.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD BEDFORD, OHIO

Circle 1 on Reader Service Card

it's LIGHT
it's simple
it's GOOD

Westinghouse
"AP" TYPE
Pneumatic Shuttle Valve

Disc-type construction—delivers either of two inlet pressures from outlet port, depending upon which is the higher. Light, simple, and efficient; provides an excellent means for a dual air supply to an operating device.

PERFORMANCE

1. Proof test—3750 psi.
2. Burst Test—2250 psi.
3. Max. Operating Pressure—1500 psi.
4. Ambient Temperature Range—
   +160 degrees F. to −65 degrees F.
5. Max. Leakage Rate—
   5 to 500 psi. 60 cc/min. Free Air
   500 to 1500 psi. 80 cc/hr. Free Air
6. Tube Connections in accordance with AND 10050
7. Available in ¼" and ⅜" tube size.

Westinghouse Air Brake Co.
AIRCRAFT DIVISION
WILMERDING, PA.

led most searchers to look to other fields. Nevertheless, the excellent viscosity index plus the ability to operate at high temperatures has kept this family as a definite possibility in the field.

Halogenated Materials

This family could involve any number of hydrocarbons in which the hydrogen molecule can be replaced with either chlorine or fluorine. The resulting material is often almost completely nonflammable and thus represents a potent possibility, providing the other necessary properties can be obtained. First, the fluid must be made stable so that the hydrogen molecules will be permanently excluded to prevent the formation of acids. The finished fluids must also be nontoxic, and finally, suitable seal materials must be developed to be compatible with the fluids. It was these last two characteristics that proved a barrier for the RPM nonflammable fluid, which has been the only serious contender announced from this family thus far. These fluids, too, are generally quite heavy and may be a great deterrent to the use of hydraulics in aircraft for this reason.

Nevertheless, because of many other attractive possibilities provided by many of these compounds, there exists the alternative of using these compounds in combination with other base materials to act as a snuffing agent. This method has been explored to a great degree by the Air Force Air Material Command with some very encouraging results. In one case, they compounded a halogenated material with a silicone and thus improved both the lubricating qualities as well as the nonflammability of the silicone base. There are undoubtedly many more possible combinations which can and will be tried and one of these may well be the final answer to the problem.

High Temperature Operation

The greatly increased speed of modern jet aircraft, together with the great increases in horsepower transmitted with hydraulics in aircraft have now injected the additional requirement for operation at much higher fluid temperatures than had heretofore been anticipated. Temperatures of 450°F and perhaps higher are a definite probability in the near future. This temperature increase has severely complicated the search for a suitable nonflammable fluid by limiting the number of base materials which can now be considered. Furthermore, much of the research effort formerly devoted solely to the search for a nonflammable fluid has now been diverted to the search for a suitable high temperature fluid, flammable or not. It can only be hoped that the fluid selected for

high temperature use will also be sufficiently fire resistant as to serve both purposes.

Summary

The past few years have seen, if not the final and complete development of a nonflammable hydraulic fluid, at least great strides toward that final goal. The fluids currently being used in service aircraft may not and probably are not the fluids which will be in service five years from now. Nevertheless these fluids have provided much valuable experience in the evaluation of such materials, and by their continued usage will provide much evidence as to the real value which can be obtained through the use of such fluids in aircraft. Industrial firms too have found and will continue to find many uses for these new developments where fires in the past have been a serious hazard.

The illustrations, Figure 1 and Table 1 illustrate most of the important characteristics of the fluids currently in use or recently considered. Table 1 is based on a chart prepared by a subcommittee of the Aircraft Research and Testing Committee. The ARTC takes no responsibility for the accuracy of the material presented, but the chart represents what is probably the most complete tabulation on this subject which is available today.

Protect
HYDRAULIC EQUIPMENT
WITH HIGH PRESSURE
MICRONIC FILTERS

• 3000 p.s.i. Operating Pressure, Micronic Filtration, Low Pressure differential, Compact in Line Type

• Maximum Protection at minimum cost. Replaceable element.

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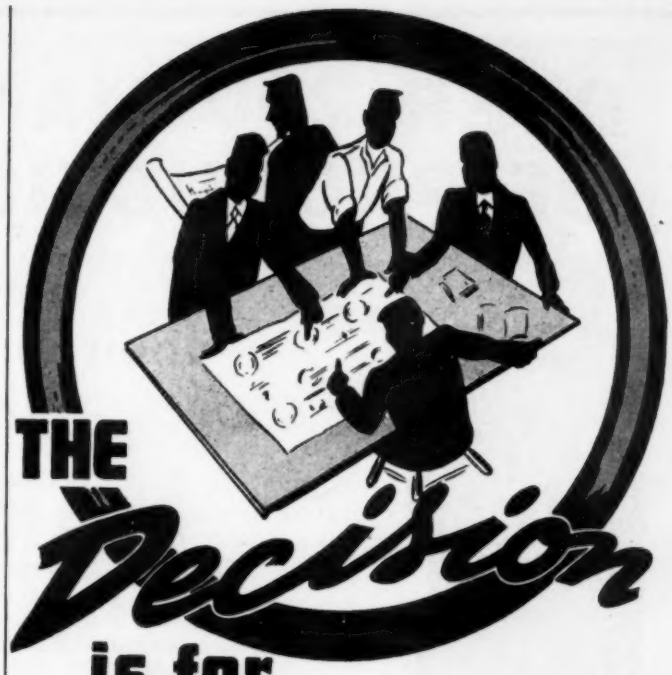
918 N. Kenilworth Ave., Glendale, Calif.

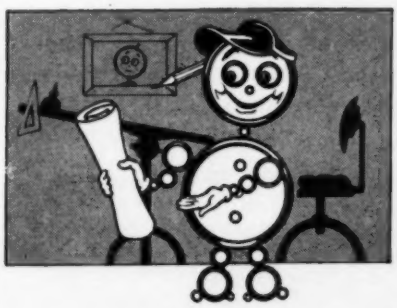
WATERMAN ENGINEERING Company
1121 CUSTER AVENUE • EVANSTON, ILLINOIS

Circle 3 on Reader Service Card



GRC 'O' RINGS

THE RESULT—*Assured*
Top Performance and Reliability



• Your product—whether new or redesigned—deserves the quality, accuracy and security of precision GRC O-ring Seals.

Their performance-proved reliability, backed by rigid laboratory-controlled processing standards, is your assurance of certain, long-life sealing under the most rigorous conditions.

GRC O-ring Seals are supplied in a wide range of approved synthetic and silicone rubber compounds to meet exacting material specifications.

Extensive engineering experience with O-ring installations throughout industry is available to you through the services of our technical and sales engineers. We will be glad to work with you in the adaption of the correct GRC O-ring Seal to your product.

For helpful design, installation and recommended practice data, write for your free copy of our O-ring Catalog "C" and Bulletin P-112.

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Goshen Rubber Co., INC.
MOLDED RUBBER SPECIALTIES, WASHERS
QUALITY MECHANICAL RUBBER GOODS FOR 35 YEARS
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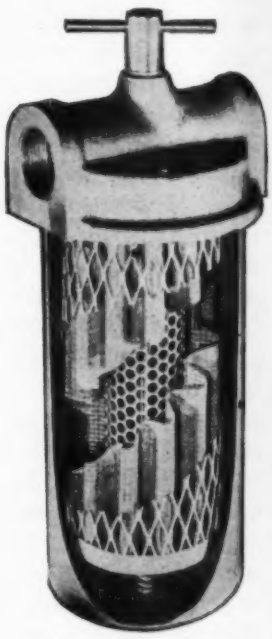
OVER 200 MANUFACTURERS OF PRODUCTION MACHINES

Sump Type (cutaway)

equip
their products
with

MARVEL SYNCLINAL FILTERS

BECAUSE Good Machines Demand Good Protection



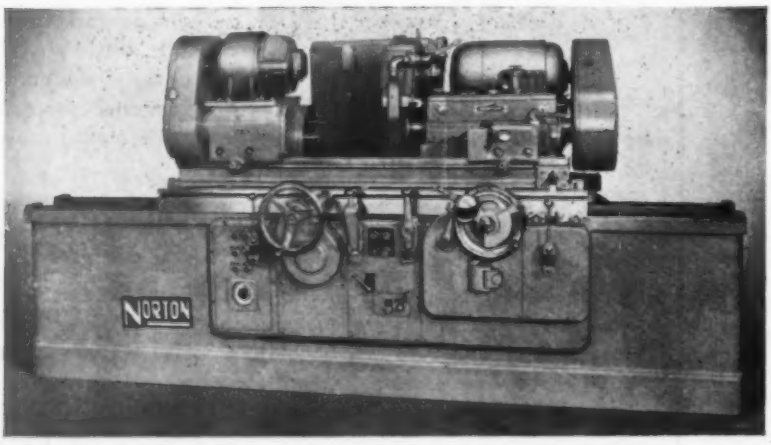
Line Type (cutaway)

FOR ALL HYDRAULIC EQUIPMENT

and low pressure systems using non-corrosive liquids. Marvel's simplicity and ready adaptability make it ideal for standardization within plants, an important feature in every preventative maintenance program. Marvel's efficiency changes down time to producing time.

FIRST COST ONLY COST.

Marvel Synclinal Filters have no moving parts to wear or get out of order. High filtering capacity for space requires less frequent cleanings, and these cleanings, including removal, disassembly and reassembly of the filter, are easily and quickly done by any workman.



NORTON 10" CTU CYLINDRICAL GRINDING MACHINE. "Marvels" do their share in keeping liquids clear of foreign matter in this and other machines produced by the Norton Company.—Photo courtesy Norton Company, Worcester, Mass.

Meets JIC Standards

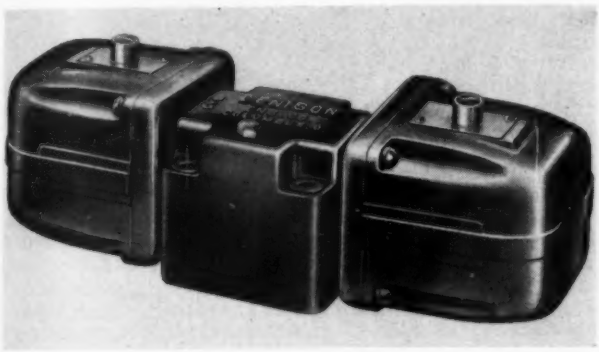
Available in both sump and line type models. Individual capacities from 5 to 50 g.p.m. and mesh sizes from 30 to 200. Multple installation provides greater capacity as you may require. Line models easily removed without disturbing pipe fittings. For efficient cleansing of non-corrosive liquids in all hydraulic and low pressure systems Marvel has your answer.

Write for Folder 105

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

application and performance of NEW COMPONENTS

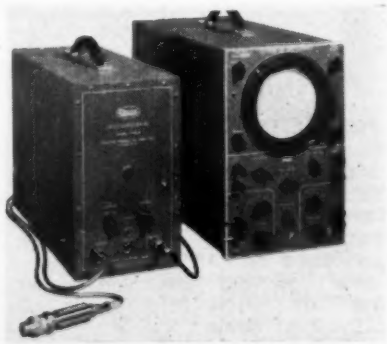
HYDRAULIC DIRECTIONAL VALVE — To overcome the problem of spool-sticking common to 4-way solenoid valves in high pressure hydraulic circuits used for long cycling operations, The Denison



Engineering Company has developed a pilot operated valve that utilizes system pressures to move this spool. Solenoids are used only to operate small internal pilot valves. As a result, spool action is said to be smooth, quick and positive under all operative conditions to 5000 psi. The valve is also designed so that the spool always moves at the same rate of speed regardless of operating pressures. The valve is available in ¾ and 1 ½ in sizes, in both single and double solenoid types, with provision for either external or internal pilot connections. Eight types of spools provide for eight different porting combinations. In the double solenoid unit, the spool is automatically pressure-centered when the solenoids are deenergized.

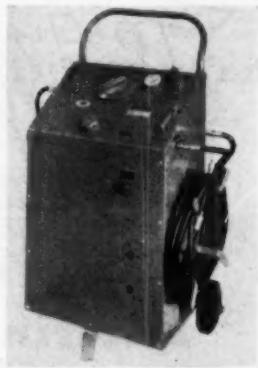
Circle 101 on Reader Service Card

PRESSUREGRAPH— This instrument provides accurate linear measurement and records pressure-time studies of static, dynamic and transient pressures of fluids. The Electro Linear Stabilized Pressuregraph provides a linear outline viewed directly on the oscilloscope; wide pressure range from .5 to 10,000 psi and a frequency response from 0 to over 20,000 cps. An electronic pickup which is connected to the region where the pressure is studied feeds a signal to an electronic circuit and power supply and to the cathode-ray oscilloscope.



Circle 102 on Reader Service Card

PORTABLE HYDRAULIC POWER UNIT — Production of a new, low cost, compact, portable hydraulic power unit is announced by Sprague Engineering & Sales. Model S-404 is designed for simplified operational and proof testing of aircraft hydraulic components and systems at high pressures —500 to 5000 psi and at low flows—approximately 1 gpm to 2000 psi. Power is furnished by a Sprague Model S-216-C air operated boost pump utilizing plant air. The unit is completely self contained, weighing 165 pounds and measuring 14 x 20 in, standing 44 in high. While designed primarily for aircraft, the machine can be used to test all types of hydraulic components and systems operating within its capacity range.

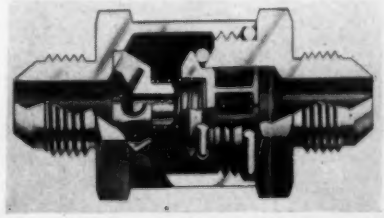


Circle 103 on Reader Service Card

REPEAT CYCLE TIMER — Offered by G. C. Wilson & Company, this timer is an electronic device employing one radio type vacuum tube and obtains its timing intervals by the charging of two resistance-capacitance networks. Operation is such that one cycle initiates the next cycle without any moving parts or external operation. The OFF and ON cycles are infinitely variable over the ranges specified and their ranges and are substantially independent on one another. Time intervals are: on ON—.2 to 200 sec; OFF—.1 to 60 seconds. These intervals are interchangeable.

Circle 104 on Reader Service Card

LEAKLESS CHECK VALVE — James-Pond-Clark, have developed two new check valves, the 800 series (illustrated) and the 8800 series. These two new valves incorporate the basic advantages of a poppet design with the operating characteristics of a swing check valve. Extremely low cracking pressure and pressure drop have been achieved without sacrificing the characteristic dead tight sealing. Both new valves incorporate the patented

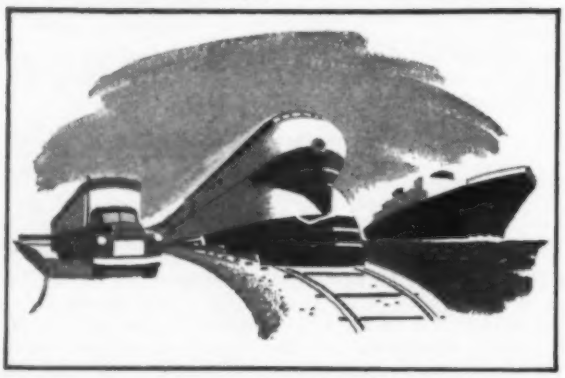


Bendix-Skinner

ORIGINATOR OF **MICRONIC** FILTRATION

the *Finest*

Answer to Any Filtering Problem



For over twenty years ***Bendix-Skinner*** has specialized in solving the filtering problems that "couldn't be done." From this experience has come entirely new and exclusive filtering techniques which do even the work-a-day filtering jobs better and at lower long-range cost. Tell us about *your* problem—nine times out of ten ***Bendix-Skinner*** filters will supply the "finest" answer.

***Over 350 Models** providing filtration from ½ micron (.000019") upwards at flow rates from 1 to 5000 g.p.m.*

SKINNER PURIFIERS DIVISION OF

1503 TROMBLY AVENUE,
DETROIT 11, MICHIGAN

Bendix AVIATION CORPORATION

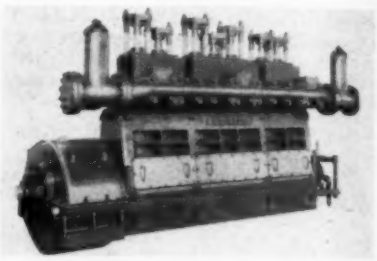
Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

Circle 58 on Reader Service Card

"Circle Seal" principle which will not leak, can be mounted in any position, utilize standard "O" rings and are not affected by vibration. The 800 series is designed to be physically and functionally interchangeable with aircraft type swing check valves. The 8800 series, while functionally the same as the 800 series, is somewhat shorter.

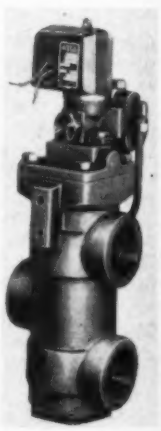
Circle 105 on Reader Service Card

6 IN STROKE RECIPROCATING PUMP — The Aldrich Pump Company announces the addition of a 6 in stroke direct flow pump series to their over - all line. This series includes triplex, quintuplex, septuplex and nonuplex units having 3, 5, 7 and 9 plungers, respectively. Ranging from 300 to 900 hp the 6 in stroke series operate at crankshaft speeds up to 300 rpm and are suitable for direct drive by engine or synchronous engine type motor. The pumps feature inverted design and a direct flow fluid end.



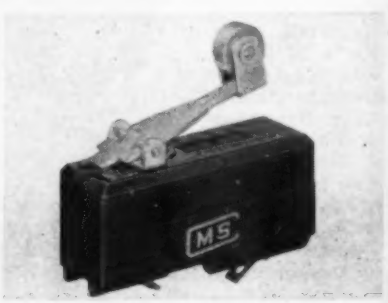
Circle 106 on Reader Service Card

3-WAY PACKLESS PILOT CONTROLLED VALVE — The recent Automatic Switch Company development is designed for controlling automatically the alternate application and exhaustion of pressure to and from equipment, cylinders or diaphragm chambers such as in the operation of diaphragm motor valves, air or hydraulic cylinders. The operating characteristic of this type of valve is such that when the solenoid is energized, the exhaust port is closed and the pressure is applied to the delivery port. When the solenoid is deenergized, pressure supply is cut off and the delivery port is connected to the exhaust. Pipe sizes are 1, 1 ¼, 1 ½, and 2 in each with designs suitable for 125 to 250 psi.



Circle 107 on Reader Service Card

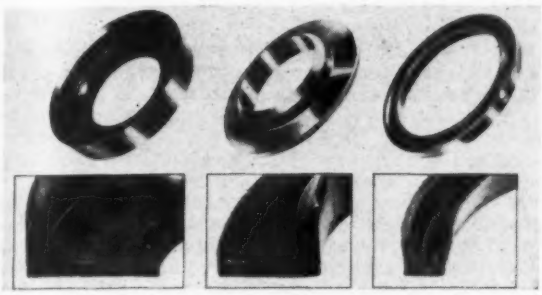
PRECISION SWITCHES — Micro Switch, a division of Minneapolis-Honeywell Regulator Company, is now offering rigid lever actuated high capacity basic switches in a new "V" series of their "Type A" basic switches. Rigid lever actuation provides a high capacity basic switch requiring a lower operating force than that offered by the flexible leaf actuated switches. This



"V" series has a .020 inch contact separation and contact arrangement is single-pole, double-throw. Three types of terminals are available: solder lugs, integral screw terminals, and side facing binder head screw terminals.

Circle 108 on Reader Service Card

PRECISION PACKINGS — Periflex, Inc. offers a line of molded packings for hydraulic and pneumatic equipment. These packings are compression molded from special fabric and neoprene compound



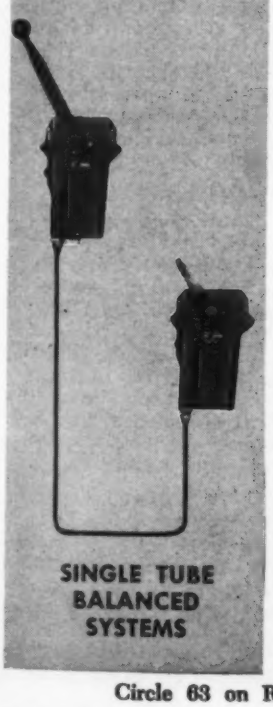
that has unusual wear qualities and resistance to a wide variety of hydraulic fluids. Because these packings are held to precision limits, they are superior in hydraulic and pneumatic systems as static seals or in traverse action applications. Designs available include cup, flange, "U" ring and "O" ring. Hundreds of precision steel molds in standard sizes are stocked to assure prompt delivery in any quantity.

Circle 109 on Reader Service Card

MORE POWER to YOU

Sperry

with *Hydraulic* REMOTE CONTROL



SINGLE TUBE BALANCED SYSTEMS

Ideally suited for feed, valve, throttle, governor, variable speed and clutch controls in all industries. F Series rated capacity 400" lbs. pressure stroke with 125" lbs. return stroke. Working stroke 60°. H Series rated capacity 50" lbs. pressure stroke with 15" lbs. return stroke. Intermediate transmitters available for multi-station control.

EASY TO INSTALL

Single copper tube permits neat, compact installations. Maintenance is simple. No compensators—no pressure accumulators.

EASY TO OPERATE

Adaptable and versatile for single and multi-purpose control. Mounts convenient to operator.

ACCURATE — DEPENDABLE

Accurate within ½ of 1 degree. Several hundred thousand cycles can be attained without interruption for service maintenance.

LITERATURE ON REQUEST

SPERRY Products, Inc.

Danbury, Connecticut

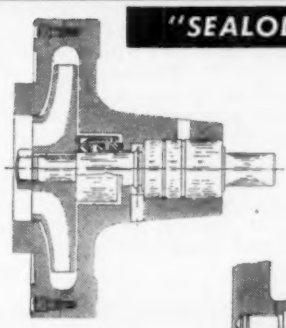
ALSO MANUFACTURERS OF METAL TESTING & MEASURING INSTRUMENTS • SELF-SEALING COUPLINGS ALLIED INDUSTRIAL PRODUCTS

Circle 63 on Reader Service Card

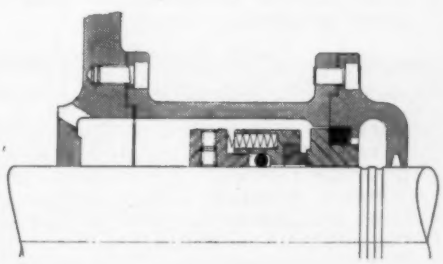
THIS NEWS TRAVELS FAST!

Where there's the WILL, "Sealol" is the WAY to get better sealing of rotary shafts. This balanced pressure mechanical shaft seal has proven itself in countless applications, handling the widest range of fluids, temperatures, pressures, and shaft speeds.

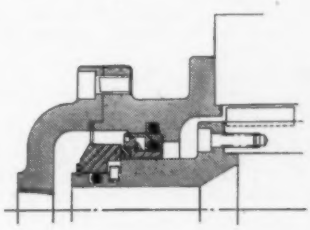
HERE ARE A FEW RECENT "SEALOL" APPLICATIONS:



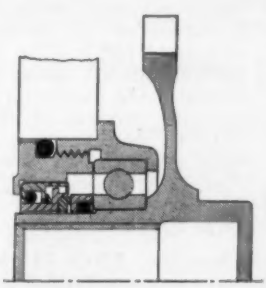
"SEALOL"
FCB Water Pump Seal (water 55 PSI, 3400RPM)



"SEALOL"
Chemical Pump Seal (dye liquor 20 PSI, 1750 RPM)



"SEALOL"
Seal for Fluid Transfer (cutting oil 700 PSI, 3000 RPM)



"SEALOL"
Seal for Power Take-Off . . . Gas Turbine Engine (oil mist 5 PSI, 6000 RPM)

If you have a sealing problem, chances are "SEALOL" CAN SEAL IT! Write for engineering recommendations. Sealol Corporation, 45 Willard Ave., Providence 5, R. I.

SEALOL

Chicago • Cleveland • Detroit • Los Angeles
New York • San Francisco

Circle 59 on Reader Service Card

Useful Catalogs and Bulletins

available for reference

Steel Tubing Data . . . Assistance in solving problems involving the use of alternate grades of low carbon, or carburizing grades of tubing steels, is offered in a new four-page bulletin published by The Babcock & Wilcox Tube Company. Known as Bulletin TDC 149, it presents condensed data on microstructure, critical points, effect of alloy elements, forging, machining, welding and thermal treatment for 14 well known alloy steels used in the production of tubular parts.

Circle 112 on Reader Service Card

"Standards" Booklet . . . Increased interest in "standards" instead of "specials" has prompted Standard Pressed Steel Co. to tell their customers just what Unbrako "standards" are and the advantages of using these standard screw products. An attractive booklet entitled Unbrako "Standards" contains detailed information about: socket head cap screws; self-locking socket set screws; socket set screw points; flat head socket cap screws; shoulder screws or stripper bolts; Dryseal thread pressure plugs; socket screw keys; square head set screws; and precision ground dowel pins.

Circle 113 on Reader Service Card

Packings and Seals . . . Durametallic Corporation offers a file folder which includes handy bulletins describing flexible metallic packing, plastic semi-metallic packing, rotary mechanical seal and all steel packing tools. Uses of flexible metallic packing include centrifugal and reciprocating pumps, and air compressors. This packing is available in both lead and aluminum foil for application in air and oil systems as well as with many corrosive fluids.

Circle 114 on Reader Service Card

Air Motors . . . New Data Sheets issued by Gast Manufacturing Corporation, describe model 1AM for 1/20 to 1/6 hp applications; and models 2AM and 4AM for 1/10 to 1 hp applications. Ten specific advantages of these light weight units are given. Model 1AM is available in 4 design variations giving you vertical or horizontal mounting with clockwise or counterwise rotation at speeds from 0 to 6000 rpm. A performance table provides hp and cfm data for varying speeds and pressures. Similar data is conveniently plotted on graphs for models 2AM and 4AM.

Circle 115 on Reader Service Card

Hose and Hose Fittings . . . Users of flexible hose will find the new Aeroquip Industrial Catalog an invaluable aid in the selection, application and maintenance of hose lines and fittings. The catalog gives complete information about Aeroquip products and contains information on construction and installation of hose lines and detachable, reusable fittings. Prepared in a loose leaf arrangement this 42 page catalog permits users to order additional catalogs consisting of selected pages. Some idea of the complete coverage offered by this catalog is gained from the subjects noted in the index: accessories, adapters, couplings, engineering, hose, hose assemblies and hose fittings.

Circle 116 on Reader Service Card

Sheet Packing . . . The Packing Division of Raybestos-Manhattan, Inc., has issued an attractively printed 8-page bulletin featuring the complete line of R/M asbestos and fibre sheet packings, consisting of woven asbestos wire inserted, pyroid, Navy grade "Dreadnaught", No. 670, K-68, No. 10,000 compressed asbestos sheet packings and "Duroil" fibre sheet. The bulletin gives complete description and illustrations of each type packing, together with full service recommendations, standard sheet sizes, and weights and thicknesses in which each type sheet is available.

Circle 117 on Reader Service Card

Motor Control . . . Allen-Bradley's fifth edition of their motor control Catalog provides complete operation and dimensional data on D.C. apparatus, drum switches, rheostats, speed regulators, starting switches, magnetic switches, limit switches, accessories and synchronous starters. This 92 page booklet includes over 60 bulletins under one cover. Useful data on machine tool control, heater element selection, conductor size and overcurrent protection of motors and full load motor currents is provided.

Circle 118 on Reader Service Card

Air Cylinders . . . Recently issued by Rivett Lathe & Grinder, Inc., Catalog Section 55 provides you with complete construction and dimensional data on the Rivett air cylinder line. Available in seven standard mountings, in 9 bore diameters from 1 ½ to 12 inches, in any length stroke up to 96 in. Both internal and external threaded rod ends are offered as standard on all models. Double end rod cylinders are also offered in four standard mountings. Design of cushion cylinders is illustrated.

Circle 119 on Reader Service Card

Snap-Action Switches . . . Micro Switch offers its new bulletin No. 54 to acquaint you with the entire scope of the Micro Switch line of over 5000 switches. It is an ultra-condensed circular of just four pages and is divided into sections, each of which deals with one clearly defined group of switches in each classification. The nine sections into which the bulletin is divided are: heavy duty limit, medium duty limit, explosion-proof, high-capacity enclosed, die cast enclosed, basic V3 switches, and actuators.

Circle 120 on Reader Service Card

Plastic Sealer . . . Bulletin B-7 is offered by Chicago Gasket Company describing "Graycote" a new plastic sealer and anti-seize compound of microfine metallic lead and a non-drying insoluble oil. Always soft, Graycote plates threads and other surfaces with a lubricating metallic film permitting

parts to be pulled up easily yet preventing the rust and corrosion which would freeze them together. The bulletin offers a complete list of suggested applications.

Circle 121 on Reader Service Card

Sensitive Relays . . . Sigma Instruments, Inc. has prepared Catalog 51-3 offering design and application data on their line of sensitive relays. They define a sensitive relay as a simple device for utilizing weak electrical signals to control circuits carrying larger amounts of power. Tables provide operating characteristics and application data.

Circle 122 on Reader Service Card

Viscosity Measurement . . . To help you to better understand the methods of viscosity measurement, the Brookfield Engineering Laboratories has prepared the "Brookfield Viscosity Packet". This group of literature includes data sheets describing the design, construction and cost of their viscometers along with up-to-date information on the general subject of viscosity. Included in this packet is a listing of article reprints, on the subject of viscosity, which are available without charge.

Circle 123 on Reader Service Card

Pump Control Switches . . . Prepared by the Square D Company, Bulletin 550 describes their pressure, float and vacuum switches for the control of pumps and compressors. Specifications for pressure switches for air compressors include a pressure limit of 250 psi and operation at a differential of 10 to 50 psi. Two types of pressure switches for hydraulic pump control are offered providing the user with a control mechanism for pressures to 3000 psi.

Circle 124 on Reader Service Card

Magnetic Clutch . . . This new development is fully detailed in Bulletin 6000 issued by the Vickers Electric Division. Representing a new solution to the problems of controlled mechanical power transmission, the clutch is a controllable coupling which utilizes the linking action of ferromagnetic particles in a magnetic field between driving and driven members to transmit torque. A complete text describes design factors, ratings and characteristics.

Circle 125 on Reader Service Card

Hydraulic "Valvbank" . . . On hydraulic installations requiring the use of two or more manually operated control valves, the application of a "valvbank" offers a number of advantages. Blackhawk Mfg. Co. offers a 4-page Bulletin 1-V which describes their standardized sections that can be built into unlimited variations of integrated combinations or sequence most adaptable to the hydraulic system. A simplified sketch shows several of the combination possibilities, and a valve cross-section shows the leak-proof construction.

Circle 126 on Reader Service Card

Complete Pneumatic Standards . . . The "J.I.C. Pneumatic Standards for Industrial Equipment", recently adopted by the Joint Industry Conference on Pneumatics as the desirable quality requirements to be specified by users of pneumatic machinery and equipment, are offered free to engineers, designers, pneumatic equipment users and manufacturers by Miller Motor Company. The standards are reproduced in full, neatly compiled in an attractive hole-punched 12-page booklet.

Circle 127 on Reader Service Card

Tell Us Your Production Problems . . . We'll Help You Solve Them

"LOGAN" AIR AND HYDRAULIC EQUIPMENT • • • SINCE 1916 • • •

Logan plant floor area, over 100,000 sq. ft.

Logan production equipment, over 150 modern productive machine tools.

Logan's approximately 500 employees have an average of 10 years with the company . . . a continuous service total of 5,000 man-years.

Logan manufactures 6,975 standard cataloged items.

Logan serves more than 6,000 customers annually; 99.6% satisfied.

Let Logan engineers help you design your Air and Hydraulic Circuits.

Logan SAVES • TIME • EFFORT • MOTION

Air and Hydraulic Equipment

LOGANSPORT MACHINE CO., INC. 832 Center Ave. Logansport, Ind.

Free Catalog On Request

- AIR CONTROL VALVES — CATALOG 100-4
- AIR CHUCKS — CATALOG 70-1
- AIR CYLINDERS — CATALOG 100-1
- AIR and HYDRAULIC PRESSES — CATALOG 51
- HYDRAULIC CONTROL VALVES — CATALOG 200-4
- HYDRAULIC CYLINDERS — CATALOG 200-2; ALSO 80-2
- HYDRAULIC POWER UNITS — CATALOG 200-1
- SURE-FLOW COOLANT PUMPS — CATALOG 62
- COLLET GRIP TUBE FITTINGS — CATALOG 44

FLUID POWER SPECIALISTS SINCE 1916

Circle 60 on Reader Service Card

Precision Limit Switches . . . Bulletin sheets have been issued by Electro-Snap Division of The Exhibit Supply Co. describing their line of limit switches for general-purpose industrial applications. These linear-actuated switches are designed to give high accuracy of repeat performance making them very suitable for the actuation of air and oil solenoid operated valves as used in automatic machine circuits. Construction of these momentary type switches clearly illustrates the simple adjustment and versatile mounting features.

Circle 128 on Reader Service Card

Protecting Screw Threads . . . Application of the precision shaped stainless steel and phosphor bronze wire Heli-Coil inserts is completely described in 16 page Bulletin 650-R. Offered in a very wide range of standard thread forms and sizes to give a Class 3 fit, illustrations clearly show the advantages of using inserts. Full installation data for both straight-through and blind holes is presented. A guide is included to assist the designer in the preparation of specification drawings for the insert.

Circle 129 on Reader Service Card

Hydraulic Equipment for Aircraft . . . Condensed Bulletin A-5200 presents the Vickers line of hydraulic components for aircraft. Built in a 3000 psi series, typical characteristics of piston type pumps and motors, pressure control valves, accumulators and transmissions are shown. Size specifications for all these components are charted.

Circle 130 on Reader Service Card

Electric Motors . . . Single phase and d.c. motors in 1 to 7 ½ hp and polyphase motors in 1 to 50 hp are described in Bulletin 400 issued by Robbins & Myers. The bulletin features all weather construction and the use of pre-lubricated fully sealed ball bearings which operate for years without attention. All motor types of the same frame size are interchangeable and have housings built to provide full protection and straight through ventilation.

Circle 131 on Reader Service Card

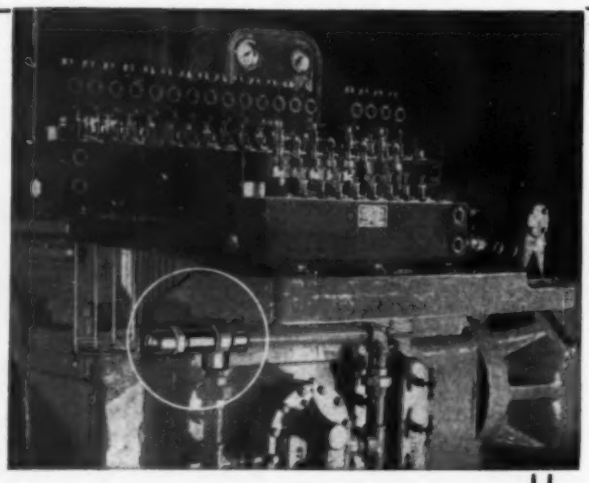
Dial Thermometers . . . For temperature control of oil on hydraulic circuits, Rochester Manufacturing Co. offers a bulletin describing their bimetallic dial thermometers. A sectional view illustrates the method of assembly and the dial reset device. Built to an accuracy of one percent of scale range, these thermometers are available in temperature ranges

Circle 132 on Reader Service Card

Electrical Relays . . . The Husky Line of relays, manufactured by the Price Electric Corporation are detailed in an available catalog. The complete line includes midget, general purpose, multipole, latching, heavy-duty and time delay relays. The catalog supplies full data on construction, operating voltages, efficiency and sensitivity to assist you in the selection of the proper relay for the control of fluid powered equipment.

Circle 133 on Reader Service Card

in distinguished company



The photo shows how dependable FULFLO valves are used on this Clark CRA-4 electric driven compressor of 500 BHP capacity.

Practically any type of equipment in which constant oil pressures are IMPERATIVE can use FULFLO Valves economically. They're CHATTERLESS; require no maintenance after installation.

Pipe sizes: ¼" to 2" standard pipe thread; STD 300# American flange valves 1" to 2½".

To establish and maintain uniform oil pressures in compressors

CLARK BROTHERS, INC.
Olean, New York
INSTALL

TRADE MARK FULFLO REG U.S. PAT. OFF.

BY-PASS VALVES

TRADE MARK FULFLO REG U.S. PAT. OFF. Specialties Co., Inc.
BLANCHESTER, OHIO

Write on your letterhead for FREE copy FULFLO MECHANICAL DATA BOOK. No obligation.

Circle 61 on Reader Service Card

Ball-Bearing Swivel Joints . . . Widely used in industrial hydraulic applications as well as in the processing industries, Chiksan swivel joints are detailed in Catalog No. 50-D. Combining two or three swivels, each turning on double rows of ball bearings, movement in all desired directions can be accomplished. Along with this 20 page catalog, Chiksan offers a 4 page Bulletin covering dimensions of their swivel joints, and a 4 page Bulletin on packing sets for all Chiksan swivel joints.

Circle 134 on Reader Service Card

Air Compressors . . . A condensed 4 page catalog describes 6 models of Joy air compressors for deliveries from 1.6 to 3656 cfm and ¼ to 600 hp. Application data on single and two stage compressors is given.

Circle 135 on Reader Service Card

Oil Control Valves . . . 25 page Catalog, prepared by Double A Products Co., presents data on pressure valves for the control of pressure, volume and direction in hydraulic systems. Information on special designs is included, and material on installation and maintenance is given. All valves in this complete line are clearly illustrated and dimensioned.

Circle 136 on Reader Service Card

Recording Thermometers and Gauges . . . The Electric Auto-Lite Company, Instrument and Gauge Division, offers an 8 page, three color Catalog. Recording and indicating thermometers are included in this line. Among their many applications is included use in temperature control work on hydraulic systems.

Circle 137 on Reader Service Card

Hydraulic Rams . . . Built by Blackhawk Mfg. Co. for hand operated and power driven systems, these rams are described in Bulletin 1-R. Designed for pressures up to 10,000 psi, single-acting standard rams are available in seven sizes having bores from ¾ in to 2 9/16 in.

Circle 138 on Reader Service Card

Springs . . . "How to Keep Spring Costs Down" is the title of a 4 page bulletin issued by Dudek & Bock Spring and Mfg. Co. Manufacturing facilities are described and a chart gives manufacturing variations for coil springs.

Circle 139 on Reader Service Card

SOLVED:

How to keep pace with growing demands in Leather and Synthetic Rubber PACKINGS

At G&K-INTERNATIONAL our laboratory, engineering and production staffs have pioneered many developments in mechanical packings, and today are tackling the toughest problems with *experience.*

Co-ordination is the reason for our plus-average in coming up with the right answer.

And because packings problems too often come up when time is critical, you'll benefit by consulting us *now* regarding packings in your business.

For PACKINGS in Grakone (Synthetic) and Leather

INTERNATIONAL PACKINGS CORPORATION

BRISTOL, NEW HAMPSHIRE

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AFFILIATED WITH GRATON & KNIGHT COMPANY

GRATON & KNIGHT COMPANY

WORCESTER, MASSACHUSETTS

GRATON AND KNIGHT

Since 1851

100 YEARS OF SERVICE TO INDUSTRY

Circle 63 on Reader Service Card

Tubing Stress Data . . . Technical information of value to engineers and designers associated with equipment operating at elevated temperatures and pressures is presented in a new data card published by The Babcock & Wilcox Tube Company. Known as TDC 102, it gives information on creep for a number of tubing steels. Creep stress data is given for rates of 1 per cent elongation in 10,000 and 100,000 hours at temperatures from 800F to 1500F for 16 popular carbon, intermediate alloy and stainless steels.

Circle 140 on Reader Service Card

Air Control Valves . . . Logansport Machine Company announces important revisions in its Logan Air Control Valve Catalog 100-4. These revisions effect only those pages covering light-duty 2 position, 4-way valves, 2 and 3-way valves and poppet type hand control valves. The revised pages provide up-to-date engineering data, information, illustrations and dimensional drawings on additional valve models plus changes in model numbers.

Circle 141 on Reader Service Card

Series Circuit Control Valve . . . Designed particularly for motor graders and other applications where simultaneous and positive action of two or more cylinders is required, Hydraulic Equipment Company's V17 series control valve has a capacity of 25 gpm with a recommended operating pressure of 1400 psi. Bulletin 107 gives a dimensioned drawing, describes the operation and design features.

Circle 142 on Reader Service Card

"The Facts of Life on Air and Hydraulic Devices" . . . Logansport Machine Co., has reprinted this informative manual, first issued in 1949. The booklet presents in concise, matter-of-fact style the "Do's" and "Don'ts" and "What To Look For" phases of setting up and servicing this type of equipment. This material was compiled specifically as a service to tool engineers, designers and maintenance men.

Circle 143 on Reader Service Card

ENGINEERED
Precision
Where You Must Have It!
Highest Quality
Molded Packings
For
HYDRAULIC
and PNEUMATIC
CYLINDERS
PRESSES • PUMPS
VALVES
Low cost insurance against leakage and failure regardless of pressures. Low maintenance costs. PERIFLEX packings are pressure molded from a special quality neoprene and fabric compound and are held to precision limits. Let us send you our catalog that lists the wide range of standard molds carried in stock.
Molded to offer automatic lip action with heel clearance—positive seal and minimum frictional drag on the rod.
CUPS
FLANGES
"U" RINGS
"O" RINGS
Periflex
Inc.
HAZEL PARK • MICHIGAN

Air and Hydraulic Cylinders . . . Designed for heavy duty industrial and steel plant applications, the Lincoln Machine Co.'s oil cylinders are built for operation to 1500 psi in bores to 8 in, and in bores from 8 to 16 in for operation at 1000 psi. The 25 page catalog gives complete construction data along with engineering data on available mounting styles. Rotating hydraulic cylinders in bores of 8 to 12 in are also described for operation of coil handling equipment.

Circle 144 on Reader Service Card

Pressure Vessels . . . Included in the Scaife Company line of pressure vessels are tanks for air compressors. A 4 page bulletin illustrates construction and available types. Tanks of capacities from 10 to 120 gallons are tabulated. Other sizes made to all codes are available.

Circle 145 on Reader Service Card

Pumps and Motors . . . The new "D" series of oil hydraulic pumps and motors, introduced by The Commercial Shearing & Stamping Company is fully described in an attractive 60 page catalog H-4. Featuring "Pressure Pocketing", these units are approved for operation at 1500 psi with volumetric efficiencies over 95 per cent and mechanical efficiencies over 90 per cent. Performance data, types of mountings, gear housing data and shaft details are given for single pumps, motors and tandem pumps. A large size cutaway drawing clearly shows the rugged, heavy-duty design. Charts and graphs quickly present pressure and capacity data.

Circle 146 on Reader Service Card

Charge Valve Applcation

(Concluded from page 64)

time; a requirement which is impossible to meet by the addition of another open center valve.

The heavy lines of the circuit show the solution to this problem. The tailgate is actuated by a closed center valve taking its power from the accumulator. When the operator presses the plunger of the charging valve, it will close the system and allow pressure to develop in the accumulator.

When the accumulator pressure is developed, the charge valve, having been set at this pressure will open to permit oil from the pump to flow to the open center system. The check valve holds the accumulator charge to operate the tailgate whenever required.

Beginner's Course

(Concluded from page 63)

from the second presure port. Then both the small and large volume pumps will operate independently as in Figure 1. However, when outlet 2 is blocked, the volume from the large pump will move through the check valve to combine with the small pump and two pressure service as described above is then available.

Feed pump—One of the many available combination pumps designed for machine tool feed applications is shown in Figure 4. This is the Sundstrand PWX series which consists of a variable displacement multi-piston pump for feeding, a constant displacement pump for rapid traverse, and the main control valves all in one housing. Thus, complete circuit control is obtained from one compact unit and the piping required between the main control valve, the feed pump, and the rapid pump is eliminated. The main control valves in the unit may be actuated by either a remote hydraulic pilot valve or a remote electric solenoid valve. Remote control valves, in turn, are actuated by the machine slide (or moving member) as it progresses through its cycle.

Four models are offered with various volumetric capacities of both pumps for each model. The piston pump develops 1000 psi while the constant volume pumps develops 500 psi maximum. The pumps are self-priming and may be used with a suction line to the oil reservoir. The variable piston pump is available in capacities up to 2.5 gpm and the constant displacement pump is available in capacities to 18 gpm. The rapid traverse constant displacement pump is an internal gear design as described in the March installment.

Circle 5 on Reader Service Card

The "M" Series valves are approx. 4⅝" high, yet have extremely fast action and large capacity for liquids, air and inert gases! They have soft insert seats to prevent leakage — will operate in any position — nylon fabric coated diaphragm for long life — max. power consumption 10 watts—continuous duty! M-2 two-way normally closed — 5 to 150 p.s.i. — port size ⅜" or ½"; orifice ⅜" — pilot operated. M-3 three-way normally closed, three-way normally open or directional flow—20 to 150 p.s.i. — port size ⅜" or ½"; orifice ⅜" — pilot operated. Special models available.

Write for Bulletin No. 493

Skinner ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
142 Belden Ave., Norwalk, Conn.

PEMACO HYDRAULIC AND AIR CYLINDERS
with the NEW
Cartridge Type Packing Gland

Designed to J. I. C. Hydraulic Standards

Pemaco Hydraulic Cylinders are soundly engineered—give long life and top performance. The steel ram is hardened to 50.C Rockwell, ground and lapped. NOW the Pemaco has the first self-contained Cartridge Type Packing Gland.

This new Pemaco "EASY-PAK" Gland is designed to comply with J.I.C. Standards. It combines double bearing surface, low friction ram seal, and a ram wiper into a single compact unit. Easily maintained, the Pemaco "EASY-PAK" Cartridge Type Packing Gland can quickly be replaced in most cases without removing the cylinder from the machine — and by inexperienced help — greatly reducing machine down-time.

Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

Write for complete information and engineering data.

PETCH MANUFACTURING COMPANY
36100 HARPER AVE.
MT. CLEMENS, MICH.

Circle 6 on Reader Service Card

Know Your Component Symbols

CHECK VALVES

Hydraulic Series

The eighth in a series showing the symbol and a typical schematic of the valve it represents.

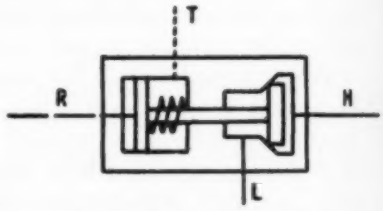
Many applications require oil flow in one direction only. Reverse flow must be checked or blocked—this is the function of the check valve. This valve is a simple device consisting of a lightly spring loaded ball blocking flow when held against a valve seat. The J.I.C. symbol clearly shows the basic construction and operation as well as direction of oil flow.

Flow in the desired direction quickly unseats the ball and in a well designed valve little pressure loss results. Flow in the reverse direction adds to the pressure of the spring to hold the ball against the seat preventing oil from passing through the check valve.

JIC Symbol

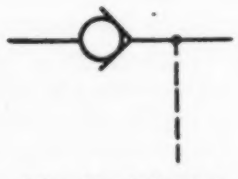
There are several methods for showing the pilot operated check valve. Performance of this valve is similar to the simple check valve, with the additional provision of allowing reverse flow when desired. Reverse flow is accomplished by unseating the ball with pilot pressure and holding the valve open to permit return flow. Simple control of pilot pressure provides this on-off action.

Shown here is a schematic



Pilot Check Schematic

of a pilot operated valve. Conventional free flow is from port L through H. Reverse flow will only take place when pilot pressure is applied to port R to unseat the poppet.



Pilot Check Symbol

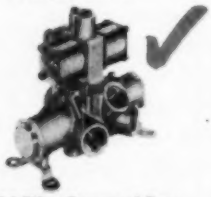
For simplicity the pilot type valve symbol can be drawn using the simple check valve symbol and the dashed pilot line indicating oil pressure can be applied to unseat the ball.

for better
automatic control
better check
general controls

PV-1 Magnetic Normally Closed Valve

PV-2 Magnetic Normally Open Valve

PV-11 Three Way Magnetic Selector Valve



PV-14 Pilot Operated Four Way Selector Valve

When it comes to automatic control of temperature, pressure, level or flow, America's leading design engineers agree that for the *best* in automatic controls, it's General Controls. The General Controls "hi-g" line of automatic temperature, pressure, level and flow controls are especially designed for use on any equipment that rolls, flies or vibrates. Positive operation in any position regardless of vibration, change of motion or acceleration, is assured. There is a General Controls Factory Branch Office as near as your telephone in 29 cities across the country. General Controls Design Specialists will welcome inquiries from Design Engineers. So for better automatic control tomorrow . . . better check General Controls . . . today!

hi-g*

* "hi-g" indicates positive operation in any position regardless of vibration, change of motion or acceleration.

GENERAL CONTROLS

GLENDALE 1, CALIF. 801 ALLEN AVENUE

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, Salt Lake City 4, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6, D.C.
DISTRIBUTORS IN PRINCIPAL CITIES

Circle 67 on Reader Service Card

Ingenious Application of Air, Oil and Water

(Continued from page 49)

erator fatigue. When the operator opens the valve, a charge of water is admitted from the accumulator and passes through the control valve to the rear member of the test fixture and the shell or seat of the valve to be tested. A poppet valve, built into the cross head of the front member of the test machine, exhausts air, insuring that the valve being tested is filled with water.

The operator watches his test gauge and examines the valve for leaks. If leaks are detected, he chalk marks the points or lines of leakage and the valve is set aside for reassembly. If the valve tests satisfactorily, it is racked in a tote box and moved on a conveyor along the line.

The valve is freed from the test fixture by the operator who steps on the treadle reversing, as noted, the foot valve and the toggle cylinder, opening the fixture jaws. Just prior to this he moves the manually operated test control valve handle to the off and drain position, which blocks the pressure coming from the accumulator. A basin catches the water drained from the valve just tested, and flows to waste. The operator "wipes" off the residue of water with an air jet.

Special Accumulator

One of the most unusual features of the valve testing machine is the water and oil accumulator. The shell of a standard 2 ½ gallon accumulator was used. Because water was used instead of air, it was necessary to modify the top or water port leading to the bladder. A safety tube, with multiple radial holes (Figure 5) was found satisfactory after considerable cut-and-try. This tube gives a rapid, evenly distributed water flow into and out of the accumulator and protects the bladder from possible perforation. A second modification was necessary on the oil side. A mound shaped safety cap was substituted for the spring loaded poppet valve regularly furnished. Small holes, around the circumference of the cap, were drilled to permit all the oil to drain from the accumulator as the bladder refills with water.

These two modifications, because they were unique as far as we know, were discussed with the manufacturer of the accumulator. His engineering staff approved of the changes and we proceeded to modify all the accumulators used in the test setups. When the test machine

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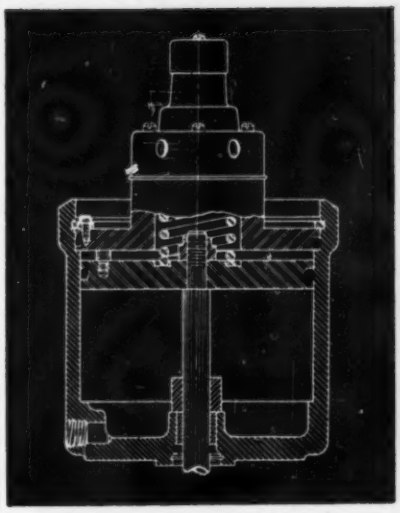
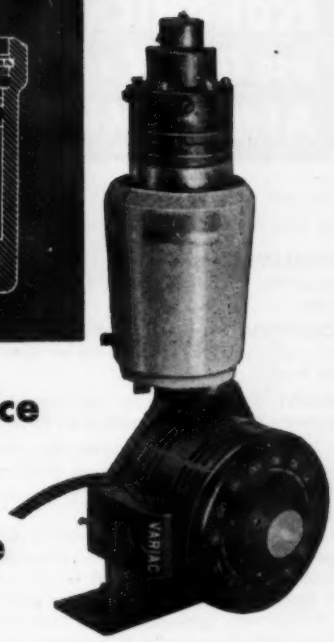




longer service

less

maintenance

...with

LINEAR "O" RINGS

Today, when longer service-life and less maintenance of operating equipment are of prime importance, it is natural that all sealing requirements of the unique Conoflow Cylinder Operators are met with Linear "O" Rings. The one-piece piston is precision fitted with a self-lubricating Linear "O" Ring. The head plate and piston stem also are "O" Ring sealed, thus eliminating the need for head bolts and gland packing.

Linear "O" Rings are compounded of natural or synthetic rubber, fluorethylene polymers, and "Silastics" . . . are molded in a complete range of J.I.C. and A.N. standard sizes, as well as hundreds of non-standard sizes and special shapes. Precision molded under rigid laboratory control, Linear "O" Rings may be depended upon for continuous and lasting service.

For easier installation and reduced maintenance, it will pay you to consult Linear during the design stages of your sealing applications.

"PERFECTLY ENGINEERED PACKINGS"

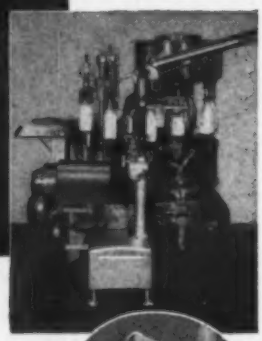
LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

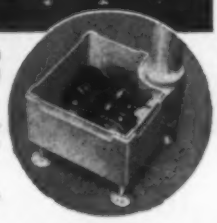
Circle 7 on Reader Service Card

Circle 8 on Reader Service Card

how to FEED MATERIALS ECONOMICALLY: use GAST rotary AIR PUMPS!



This unit, for example, seals milk bottles with Aluma-SEAL aluminum caps . . .



PROBLEM: Remove caps one-at-a-time from magazine, and hold ready to drop into feed chute.

SOLUTION: Suction cup with 20" to 22" vacuum, produced by positive-action Gast Rotary Air Pump.

RESULT: Dependable, low-cost operation from portable Gast unit in housing on floor.

Just for a moment, consider how you could apply low vacuum for feeding sheet materials and small parts of paper, fibre, plastic or light metal.

The possibilities are enormous for extra speed — extra savings — extra safety. And Gast Rotaries are giving excellent service on scores of common — and unusual — applications.

When you have problems that might be solved with low vacuum or pressure, write Gast. "Air may be your Answer!"

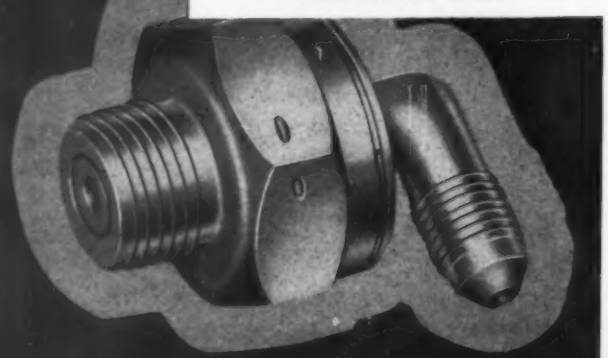
see our CATALOG in SWEET'S FILE

Gast Application Ideas Booklet — showing 26 design problems solved — sent upon request.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY AIR MOTORS • COMPRESSORS • VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

CHIKSAN
HYDRAULIC SWIVEL JOINTS



This is but one of many different Types and Styles of CHIKSAN Hydraulic Swivel Joints for application on all hydraulic lines which must turn or swivel. Pressure capacities range from 1000 psi. to 3000 psi. Write for Bulletin A. Or tell us your requirements and CHIKSAN Engineers will gladly cooperate with you in developing Hydraulic Swivel Joints to meet your requirements.

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
Chicago 3, Ill. BREA, CALIFORNIA Newark 2, N. J.
WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS
CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

(Concluded from preceding page)

is unloaded, the toggle mechanism is in the open (toggle arms down) position, simultaneously releasing air pressure on the pilot of the four-way oil valve.

Accumulator Boosts Water Pressure to 1250 psi

The accumulator fills with water during the unloaded period. As soon as the operator lifts another valve into the test machine, he steps on his treadle to begin another cycle.

The three cycles are coordinated to give a fast flow of water under a preset pressure. The operator starts the motor and pump. With the motor running and the pump delivering oil to the four-way valve, oil will bypass through the valve to the tank and flow from the accumulator to the tank. At the same time the accumulator bladder will fill with the 50 psi water from the plant supply line.

The jaws of the test fixture are adjustable for a range of valve sizes. The pressure desired for a given size or type valve is set, as noted, by the stem of the relief valve integral on the combination pump. It is possible to make a valve size and pressure adjustment changeover very simply and quickly.

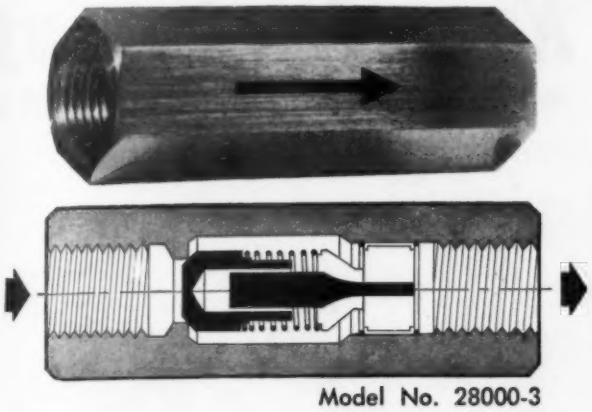
One of the details that may have caused us some trouble, the sealing of the valve faces when the valve was being tested in the fixture, actually gave no trouble. The valve is held by only approximately 100 pounds of mechanical pressure. A special rubber seal mounted on the fixture faces sealed adequately without leakage at 1250 psi, the highest pressure used in the battery of machines shown in Figure 1. For higher pressure valves not exceeding 2 inches IPS, we are successfully testing at 3000 psi on equipment of similar design.

Results in Reduced Unit Cost

The test setups in our valve shop are the result of a number of years' experience in testing valves; the modifications, particularly the use of water in the accumulator and the adaptation of an air pilot to operate the four-way hydraulic valve were the result of efforts to simplify and accelerate the test procedure and provide accurate and shockless pressures. Our test equipment is flexible, easily controlled and maintained. With widely varying pressures for valve testing we have found that the combination of air, oil and water circuits has greatly increased the average daily test production at a corresponding reduction in unit cost.

Circle 9 on Reader Service Card

Circle 69 on Reader Service Card



Model No. 28000-3
⅜ Pipe Size—For Oil

CHECK VALVES

- LOW PRESSURE DROP
- ONE PIECE BODY

NO GASKETS TO LEAK
WILL NOT COME APART
WHEN FITTINGS ARE REMOVED

- ECONOMICAL

FLUID CONTROLS, INC.

Box 186B Willoughby, Ohio

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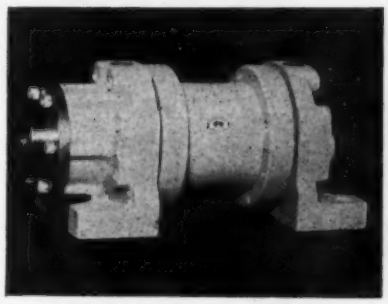
The Biggest PLUS Value In Cylinders

Air — Oil — Water



Sturdy

Dependable

Economical

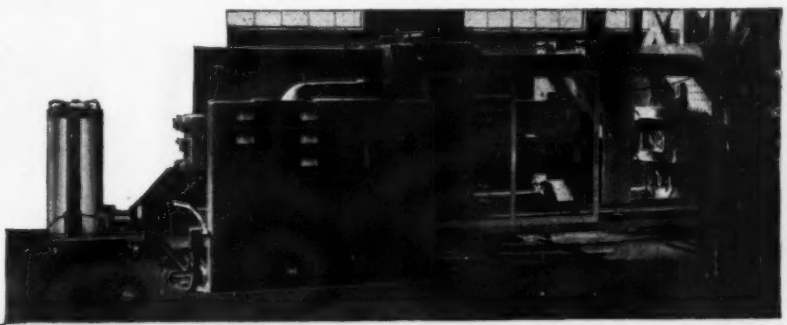
Designed and Constructed
to J.I.C. Standards

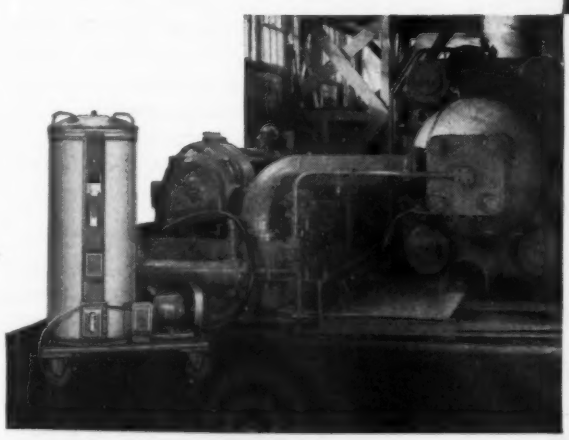
Non-scoring piston rings —
Special rod packings —
Hardened, chromed rods —
Rod scraper —

Prompt Deliveries

NEPTUNE-POWER PLUS PRODUCTS
Company
2228 Bellevue, Detroit 7, Michigan

world's largest injection molding press



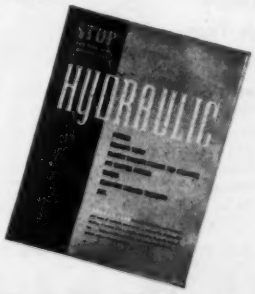


● This 69-ton, 300-ounce Watson-Stillman press accommodates dies up to 72" x 48". One of 14 injection molding machines at Amos Molded Plastics, Edinburg, Indiana, it employs a 7½-ton, 550 gallon hydraulic oil pumping unit (shown above being serviced by Honan-Crane Oil Purifier). Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.

gets Honan-Crane Hydraulic Oil Purification

... world's most dependable protection against damage, downtime, lost production due to contaminated, oxidized oil!

FREE! New 8-page "Hydraulic Bulletin" and Hydraulic Oil Case Histories describe in detail the profitable advantages of Honan-Crane Oil Purification in Plastic molding operations and many other critical hydraulic applications. Write to us for your free copies TODAY!



CLEAN OIL ENGINEERING

Honan-Crane Corp.
102 WABASH AVE. • LEBANON, INDIANA
A Subsidiary of **Houdaille-Hershey Corp.**

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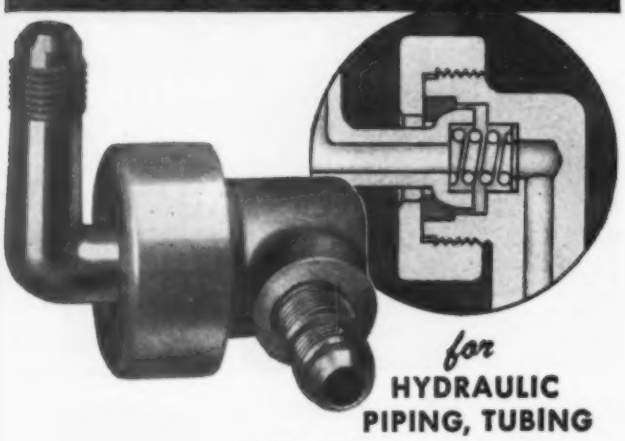
Circle 71 on Reader Service Card

LEAKPROOF! NO BINDING!



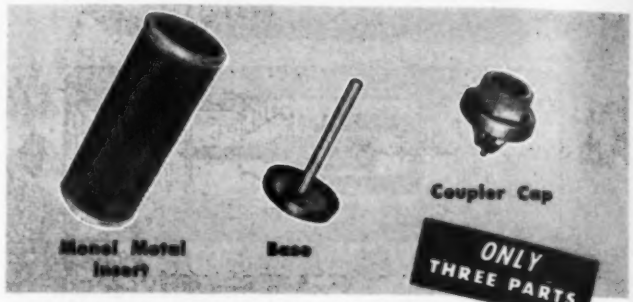
for HYDRAULIC PIPING, TUBING

BARCO *High Pressure* SWIVEL JOINTS

WHEREVER hydraulic piping or tubing must move, use Barco Swivel Joints! Barco's exclusive design provides *side flexibility* to allow for piping misalignment and to PREVENT BINDING. *Only Barco offers this important advantage.* Widely used for making compact, low torque swivel connections to reciprocating or rotating parts. Ends the nuisance of sagging, flopping non-rigid lines. LEAKPROOF; SAFE! Suitable for extremely high or low temperatures. Ratings to 3,000 psi, or higher. Choice of styles, ⅛" to 2", angle or straight. *Ask for Bulletin 265.* BARCO MFG. CO., 1832K Winnemac Ave., Chicago 40, Ill. *In Canada:* The Holden Co., Ltd.

Circle 72 on Reader Service Card

Keep it running with CAPITAL OIL FILTERS



EASY TO INSTALL, CLEAN AND MAINTAIN AT TOP EFFICIENCY

Avoid costly breakdowns with the new Capital hydraulic reservoir type oil filter which features a non-corrosive, trap-weave wire cloth, giving clean oil at an extremely low pressure drop. Get full protection — various sizes of filter screens can be interchanged in minutes — can be cleaned without taking apart. Its greater filtering area traps all foreign particles and helps to keep your equipment running at top efficiency.

Capital filters designed to J.I.C. standards are available in filtering capacities of 5, 10, 20, 30 and 50 gals. per minute. Larger capacity sizes can be supplied to meet special requirements. Get bulletin AH-1 for complete details.

CAPITAL

Select territories are available to progressive distributors. Inquiries invited.

ENGINEERING & MFG. CORP.
5837 South Ashland Ave. • Chicago 36, Ill.

QUICK DELIVERY ON VALVES!

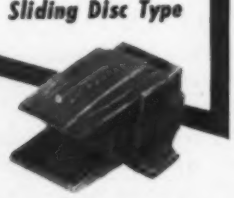
HANNIFIN *precision built* **VALVES**

for single or double-acting cylinders

Hannifin precision-built valves are *reliable*—and quickly *available!* For positive, accurate control of air-powered equipment, there is a Hannifin valve that will give long-time service in production operations.

QUICK DELIVERY IN ANY QUANTITY!

"Effortless" Sliding Disc Type



"Packless" Rotary Disc Type

Hand operated. Simple design avoids leakage, waste of power—gives positive control. Sizes ⅛" to 1¼".

Also foot-operated types—leave operator's hands free. Sizes, ¼" to ¾".

Foot operated. Fast, effortless action. Pilot operated, air pressure does the work.

Also finger-tip actuated models.

Write for Bulletins 57, 240, 241

HANNIFIN

Hannifin Corporation • 1155 S. Kilbourn Ave. • Chicago 24, Illinois

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GOOD PACKINGS *must start with the* TANNING

To make Rhoads Tannate Leather Packings a wide variety of specially developed packing leathers are used. These have been tanned by our own process, the culmination of nearly 250 years of producing fine leathers. Skilled craftsmen, long experienced in packing manufacture and application, precision mold and custom finish Rhoads Packings to meet your exact requirements and specifications.

U—VEE—CUP—FLANGE

RHOADS *Tannate*® **LEATHER PACKINGS**

Specify Rhoads Tannate Leather Packings for more dependable service, increased production and lower costs. ***Write for details.***

PRODUCERS OF FINE LEATHER FOR 249 YEARS

J. E. **RHOADS** & SONS

35 North Sixth Street, Philadelphia 2, Pa.

Circle 74 on Reader Service Card

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

James Robinson, Chief Engineer of **Vickers Incorporated,** Division of the Sperry Corporation, recently announced the appointment of **Duncan B. Gardiner** as assistant Chief Engineer.

D. B. Gardner

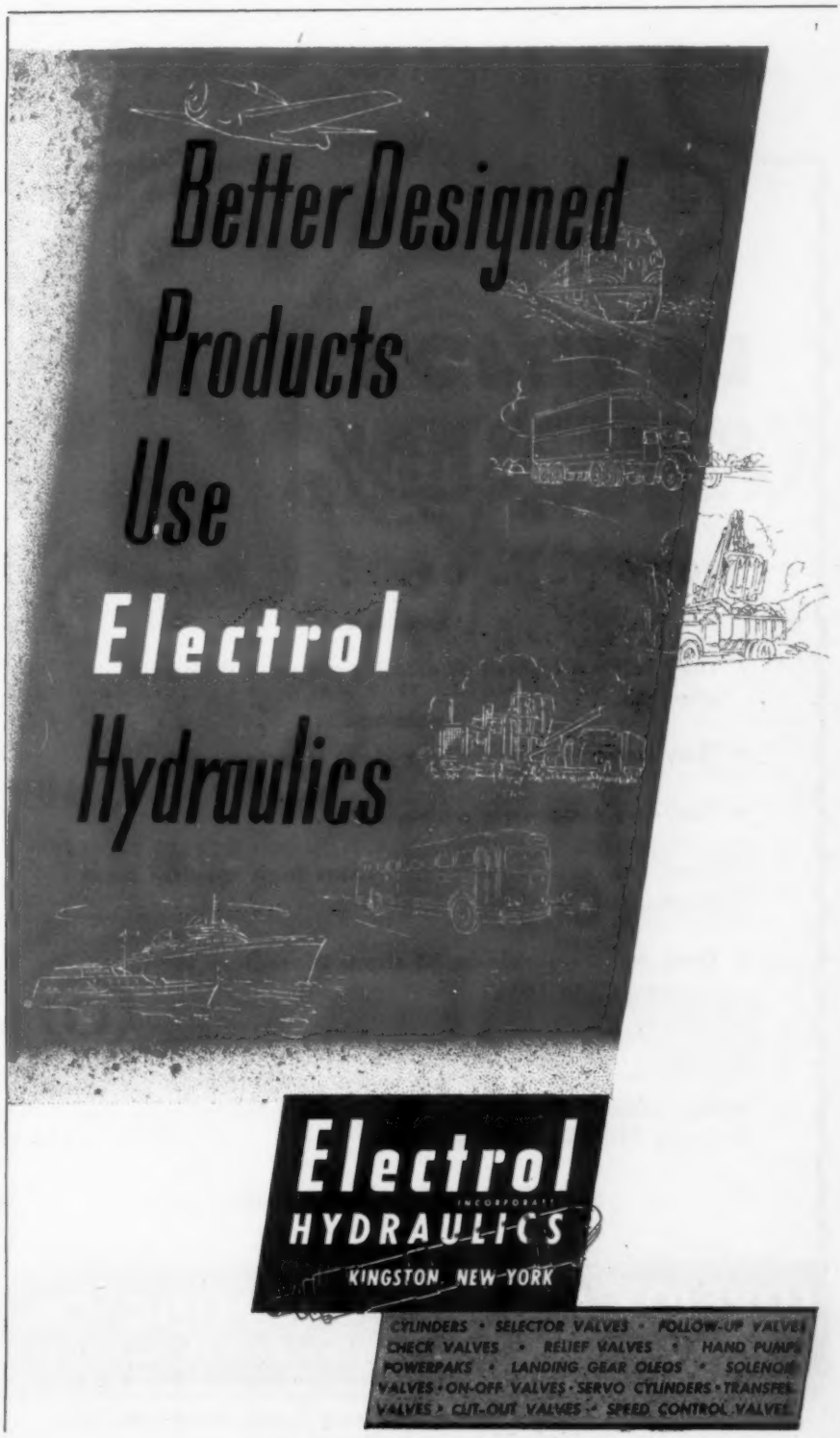
Prior to this, Mr. Gardiner was Chief Product Development Engineer since 1944, after serving as a Product Engineer in the company's Navy, Industrial and Air Divisions for a total of 16 years.

W. D. Espy has been elected as a vice president of **Lear, Incorporated,** Grand Rapids, Michigan. Other newly elected officers include **A. Durham** to the post of assistant secretary and assistant treasurer, and **George K. Otis,** of the Los Angeles office as assistant secretary.

Dr. J. Robert Downing, Director of the **Cook Research Laboratories** of Chicago, announces that several additions have recently been made to the engineering staff. One of the most recent staff additions is Dr. Joseph F. Zeichmeister who will fill the position of assistant chief engineer. For the past 13 years, Dr. Zeichmeister was associated with the Gaertner Scientific Corporation of Chicago as a physicist and engineer.

Construction of new general offices and plant facilities of the **Crane Packing Company** of Chicago has been announced by Frank E. Payne, company president. The new plant site, situated on Oakton Avenue near Lehigh in Morton Grove, Illinois, will cover 133,000 square feet when completed.

Acme Industries, Inc., has announced the appointment of **Vernon Tupper, Jr.,** as southern regional sales manager.



Circle 75 on Reader Service Card

The Cleco Division of the Reed Roller Bit Company, Houston Texas has announced the appointment of **Byron Stoothoff** as Division manager of Division 600 with headquarters in Cincinnati. Cleco has also appointed as distributors: Franklin Supply Company, 184 Broad Street, Providence 3, Rhode Island; J. Heller & Sons, Inc., 149 Ferry Street, Newark, New Jersey; and Someset Pneumatic, Inc., Somerville, New Jersey.

A. H. Borchardt has been elected a vice president of **Worthington Pump and Machinery Corporation.** Mr. Borchardt will have the overall responsibility for the sale of the corporation's entire line of pumping equipment, including centrifugal, reciprocating and vertical turbine pumps.

Herbert B. Link, executive vice-president since 1939 of **The Bellows Co.,** Akron, Ohio, manufacturer of pneumatic equipment, has been named president of the company. Mr. Link succeeds L. F. R. Bellows who died May 28. **L. F. R. Bellows, Jr.,** was named vice-president, and **Byron D. Kuth,** secretary-treasurer.

Herbert B. Link

W. C. Richards, Jr. has been named executive assistant to the president of The Bellows Company, Akron.

Herman H. Miller, manager of the Compressor Division of **Worthington Pump and Machinery Corporation** in Buffalo has relinquished the managership of the division to act as consultant to his successor **E. A. Murray.** Mr. Miller, a 50 year Worthington veteran, plans to retire at the end of this year.

Raymond F. Halen has joined **The Parker Appliance Company** as Aircraft Sales Engineer.

Hydraulic Press Manufacturing Company, Galion, Ohio has built a new 175 x 126 ft plant to handle the assembly of hydraulic pumps, power units, motors, valves, cylinders and boosters.

Van Dusen Aircraft Supplies, Inc., Minneapolis, has been appointed distributor for "O" rings manufactured by **The Parker Appliance Co.**

Here's why

LOVEJOY UNIVERSAL JOINTS

are so popular . . .

- **They have a liberal operating angle with maximum strength.**
- **They have flush rivets for close quarter work.**
- **They are concentric within .001".**
- **They are precision-ground from high quality heat treated alloy steel.**
- **They are available in 13 sizes: Diameters ½" to 4", Lengths 2" to 10⅛".**

Use the best universal joints . . . use the universal joints which are the "standard" in industry . . . use Lovejoy Universal Joints.

Send for complete information.

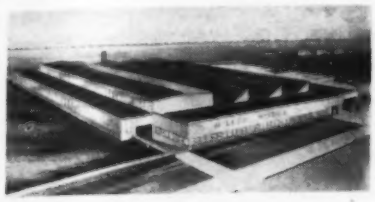
LOVEJOY FLEXIBLE COUPLING CO.

5037 W. LAKE ST. CHICAGO 44, ILLINOIS

Also Mfrs. of Lovejoy Flexible Couplings and Lovejoy Variable Speed Transmissions.

Circle 76 on Reader Service Card

Miller Motor Company, Chicago has built a modern, new plant comprising an area of about 50,000 square feet at Melrose Park, Illinois, a sub-



urb within the Chicago metropolitan area. The new plant represents the very latest in modern plant design and layout and is equipped with the most modern machines and production facilities. Two unusual features of the plant's interior design are the use of "color dynamics" and complete inter-visibilty between all departments.

Theodore F. Smith, president **of Oliver Iron and Steel Corporation of Pittsburgh,** has announced the merger of Berry Motors, Inc. of Corinth, Miss. into the Oliver Iron and Steel Corporation. **Frank Berry** becomes director of research of the Berry Division and **Ara A. Cambere,** formerly president of Berry Motors, Inc., was elected a vice president of Oliver Iron and Steel Corporation in charge of the new division. **John R. Carlson** will continue to direct the sales of the Berry Division.

Walter V. Scholz has been appointed technical representative for the hydraulics section of the **R. M. Hollingshead Corporation's** industrial-aviation division. Scholz will work with military air frame manufacturers and Naval air stations on the technical phases of H-2 non-inflammable hydraulic fluid.

J. F. Ray, vice president in charge of sales for **General Controls Co.** of Glendale, California, has announced an expanded field engineering force, coupled with a new district organization plan. Five new factory branch offices in Salt Lake City, El Paso, Omaha, Milwaukee, and New Orleans brings the total to 29. Managers of three of the new offices are **John Ferguson,** Salt Lake City; **Albert Smith,** Milwaukee; and **Elton Barnett,** Omaha.

General Controls has also laid out six districts: New York district under supervision of **F. J. Wengerter;** Philadelphia district under **Fred Angier;** Cleveland district under **Charles Tabor;** Chicago district under **Bud Lerch;** Denver district under **Herbert Lindstrom;** Houston district under **A. E. Hess.**

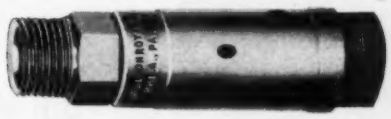
Greater Resistance to Shock Loads and Flexing

MULCONROY
Hydraulic
HOSE ASSEMBLIES

With
"PRESS-LOCK" COUPLINGS

These patented couplings, because of their completely different design and construction, provide MULCONROY Hose Assemblies with unequalled resistance to shock loads and the effects of continuous flexing. As illustrated at lower right, entire hose wall is utilized, with hose and coupling combined in an inseparable three-way gripping arrangement.

Complete units, ready for quick, easy installation on all types of hydraulic equipment. Available in three basic constructions meeting all required working pressures. Lengths up to 50 feet.



Exterior View "PRESS-LOCK" Hydraulic Hose Coupling.

"PRESS-LOCK" Cross-Section. Note Employment of Entire Hose Wall, All The Way.

Write for Illustrated Catalog

"MULCONROY *Starts...* WHERE OTHERS *Stop!*"

MULCONROY CO. *Hose Specialties Since 1887*
5329 JEFFERSON ST., PHILADELPHIA 31, PA.

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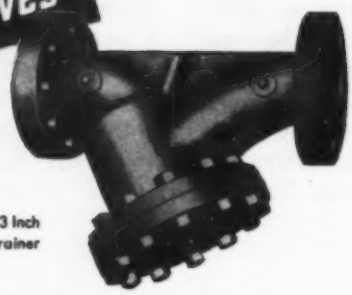
Circle 10 on Reader Service Card

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves



No. 16050 3 Inch
Hydraulic Strainer

HIGH PRESSURE HYDRAULIC STRAINER to 1500 p.s.i.
protects valves, cylinders and spray nozzles

● Repay their cost many times over. Widely used in steel mills and forging shops to prevent partial plugging of spray nozzles, resulting in rejects due to scale streaks. Cast electric furnace steel housing. The strainer consists of machined and grooved bronze rings nested around a heavy slotted multi-ported bronze back-up cylinder. The rings can be loosened and cleaned easily with compressed air, or completely removed and cleaned in solvent. 1½" to 6" sizes. Send for Data Sheet No. 3402. *It gives full details.*

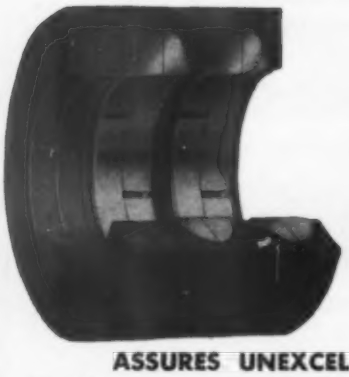
THE HIGHER THE PRESSURE THE TIGHTER THE SEAL

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated
Mfd. by C. B. HUNT & SON, INC., 1965 E. Pershing St., Salem, Ohio

MONOPAK
METALLIC PACKING

Prolongs the Life of Hydraulic Cylinders



Seals against Oil, Water, Brine, Air, Gases and Refrigerants

ASSURES UNEXCELLED DURABILITY

Burst-proof, does not blow out . . . Compact and easy to install . . . Low Friction insures long life. Now adopted by hundreds of manufacturers and users of machine tools.

Write for Literature

HYDRAULIC ACCESSORIES CO.
439 E. Fort St. · Detroit 26, Mich.

Danger Spots In Hydraulic Circuits

(Concluded from page 51)

combined with shock and vibration can easily lead to a serious break. *Careless piping practices must not be tolerated in areas where oil and fire might mix.*

Safety Begins with Good Design; Is Maintained by Good Workmanship

The above points should be kept in mind by the engineer who designs a new, self-contained machine, e.g. one that will be used with molten or hot metal, hot organic materials. His concern in producing a safe machine should start, no matter what the ultimate use, with the initial design of the oil circuit.

Simplicity should be the keynote. The equipment he selects should have the auxiliary valves and controls built integral with the fluid power unit, to eliminate most of the external piping and fittings. All pilot valves should be enclosed in compartments and all pilot piping should be shrouded in race-ways. All power piping should be of steel with welded, flanged connections to the cylinders. The entire design should avoid inaccessible pockets in which dirt and oil will collect.

The circuit design should be critically examined for shock. Destructive surges are most easily cured on the drawing board. Particular attention should be paid to return or drain lines. Such lines, protected by a low pressure relief valve or open to reservoir, are often considered safe. However, sudden changes in rate of flow can cause very destructive high pressure peaks in such lines.

"Floating" Gland Design

(Concluded from page 60)

stretched over the rod. While this gives interference, there is no cross-sectional squeeze. And, again, the groove is cut so that the "O" ring does not contact the bottom.

The total radial squeeze in the "floating" gland design using 5 per cent compression on the o.d. is approximately .200 inch when using a 4.000 inch bore. Standard recommendations for a conventional design call for about .017 inch squeeze on the cross-section of the ring. It is easy to see that the "floating" gland gives several times as much interference to wear down before losing contact with the sliding surface than the conventional gland.

Interference obtained by using the "floating" design makes it possible to get as much or more interference as any other type of packing. The writer does not know of any gland design for

Circle 11 on Reader Service Card

an axial seal which will allow the seal to wear more than the initial interference. Lip, cup and similar seals usually have a relatively thin flat cross-section. The round solid cross-section of the "O" ring gives it an advantage in that it can be compressed more (on the o.d.) before buckling occurs.

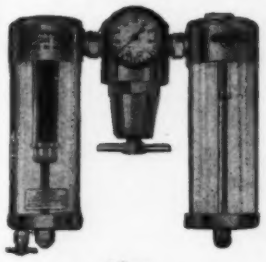
It may seem surprising that a gland of the "floating" type would work at all. However, the ones tried to date not only work, they have reduced running and breakout friction as much as 80 per cent at low pressures, increased the life of the seal and reduced the very slight leakage that is normally present with designs that use relatively long grooves. In addition to all this it was tried on an air and oil combination application recently that had leaked excessively at —35F with a conventional gland. The "floating" gland sealed the unit down to —80F as well as under all other conditions.

It is pointed out that this is a new gland design and only a few applications are in field service. Only favorable results have been reported to date; however, we feel at this stage of the game, that considerable more testing is necessary to determine the limits as well as the advantages of the design. When used singly it is believed that its use should be restricted primarily to air applications.

Circle 12 on Reader Service Card

"M·B" AUTOMATIC
Air Line FILTER, REGULATOR and LUBRICATOR ASSEMBLY

"Sentinel of the Air Line"



Also Pneumatic Grinders

"Remember, Built-in quality remains long after first-cost disappears"

FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR is capable of passing large volume with an unrestricted flow and minimum amount of pressure drop. Self-bleeding, compact, simple. Machined from bar aluminum. LUBRICATOR delivers desired volume of oil. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure. Bowl can be refilled without shutting off air supply. Any of these 3 devices can be used as separate units or in any combination.

Write for Literature

M·B PRODUCTS
46 Victor Ave.
DETROIT 3, MICHIGAN

That ten years ago custom rubber products manufacturers considered the molding of rubber to a tolerance of plus or minus 1/64 of an inch good? Today, in some instances, *Plastic and Rubber Products Company* holds rubber molding to a tolerance of 1/1000 of an inch.

The high quality of *Parco* rubber products is obtained by holding close tolerances and very carefully controlled compounding and processing. Perfection where it counts may solve your problem. Insist on *Parco* for this perfection in "O" Rings. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

Catalog and engineering data on request. *Write us today.*

Plastic and Rubber Products Co.
2100 Hyde Park Boulevard, Los Angeles 47, California
820 North State Street, Chicago, Illinois

Circle 78 on Reader Service Card

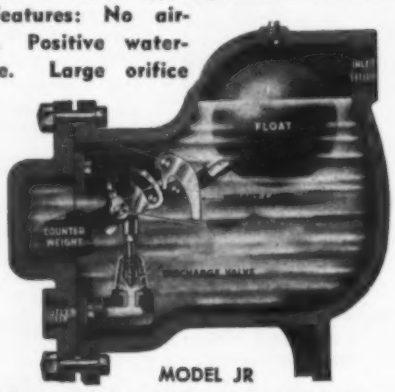
New NICHOLSON

NON-PLUG AIR TRAPS

Introduce Oil-Eliminating Feature Preventing Build-Up of Scum and Sludge

In these Nicholson air traps you enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Three types; pressures to 1500 lbs. Other features: No air-wasting vent. Positive water-seal at valve. Large orifice keeps valve clean. For details send for . . . .

Bulletin 651



MODEL JR

W. H. NICHOLSON & CO. 213 OREGON ST. WILKES-BARRE, PA.

Sales and Engineering Offices in 55 Principal Cities

★ REDUCE DOWNTIME WITH HILCO

HYDRAULIC OIL FILTERS...

THEY KEEP YOUR OIL CLEAN BY REMOVING PRODUCTS OF OXIDATION, ACIDS, SLUDGE AND MOISTURE

HILCO FILTERS WILL PREVENT SLUDGING, PUMP AND VALVE FAILURES...

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THE HILLIARD CORPORATION
148 W. FOURTH ST., ELMIRA, N. Y.

IN CANADA—UPTON-BRADEEN-JAMES, LTD.
990 BAY ST., TORONTO-3464 PARK AVE., MONTREAL

Circle 79 on Reader Service Card

Positive Counting of Parts Moved By Conveyor

A VERY COMMON REQUIREMENT OF CONVEYOR handled boxes, packages or other units is an accurate count. Counting devices, whether mechanical, electrical, electronic or some combination, often can be jammed or "fooled" when units on a conveyor line up so solidly behind the point where the counter is installed. A relatively simple, positive counter that invariably gives an accurate record of the number of units that pass over it, is obviously a valuable aid in all types of plants.

The Alvey Case counter is a self-contained, belt driven, limit switch actuated device with an air operated package release. It can be used with either a mechanical or an electric type counter.

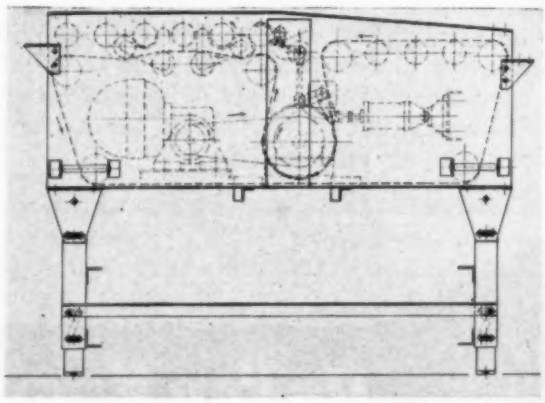

Fig. 1. Elevation sketch of counter showing arrangement of belt and location of automatic air operated package release.

The four foot unit is designed to fit into a standard conveyor line. The incoming line may be gravity, belt or live roller type. A motor driven belt carries boxes or packages to the center of the unit against a stationary stop or barrier. As the package touches the barrier it contacts a roller lever type limit switch which, when actuated, operates both the counter and the automatic package release.

The package release is operated by a 2 x 2 inch air cylinder fitted with an integral electric air valve. As the cylinder rod extends, the release roller is lifted through a toggle arm arrangement. As the package is over the release roller, this lifts the front end of the package to the level of the live rollers on the discharge side. The belt then propels the case over the barrier. As the package clears the barrier roller, a second limit switch mounted behind

the stop is actuated, reversing the valve, retracting the cylinder and causing the roller to drop and return to its starting position.

Either a mechanical or electrical counter may be used. When a mechanical counter is used the tripping arm of the counter is actuated each time the release roller lifts a package over the barrier. If it is desirable to place the counter at a remote location an electric counter is used. In this arrangement the counter circuit is closed each time the air valve circuit is closed to raise the release roller.

The belt arrangement is shown in Figure 1. The belt is driven over a live roller by means of a short belt drive from a 1/3 hp Gearmotor. The belt path is over the top of the inlet rollers, around the drive roller, across the discharge side under the live rollers, around idler rollers at the discharge end, an idler roller at the inlet end and back over the inlet rollers. On the discharge side the belt goes over idler rollers which hold the belt against pivoted intermediate rollers, held in turn against the top discharge rollers. This arrangement causes the top rollers to rotate toward the discharge end.

The capacity of the counter is approximately 40 packages per minute.

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MIDGET AIR-CLAMPS
Pneumatic Cylinders

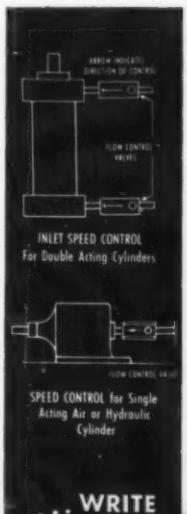
Horizontal and Vertical!

Both models deliver 80 lbs. pressure on a line pressure of 100 lbs. They'll save countless man-hours in assembly operations involving welding, riveting, bolting, etc. Advantages over mechanical clamps: 1, Any number can be operated by single master valves. 2, Easily installed in cramped corners. 3, Equal ram pressure at any stroke point. Send for new Mead AIR POWER Catalog, describing our line of Air Clamps, Air Vises, Air Presses, Work Feeders, Valves, Controls, etc.

MEAD SPECIALTIES COMPANY

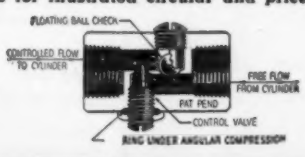
4114 NO. KNOX AVE., DEPT. AH-91 CHICAGO 41, ILL.

FLOW CONTROL VALVE
for Cylinder Speed Adjustments OVER A WIDE RANGE IN AIR OR HYDRAULIC USE



The Pneu-Trol Flow Control Valve combines an efficient Stainless Steel FLOATING BALL CHECK which opens and closes at the slightest change in flow direction, with a Vernier Type VARIABLE NEEDLE ORIFICE adjustment in a compact control which has widened air and hydraulic cylinder application by providing precise control of cylinder action. Modifications of the Pneu-Trol Valve are available as Plain Check, check with Fixed Orifice (orifice drilled by customer in the Standard Check Valve), Needle Valve and Velocity Limiting Check, as illustrated at left. All Pneu-Trol Valves are made from bar stock in brass (up to 1000 psi) or steel (5000 psi) or other body metals to your specifications. All internal parts are Stainless. All valves available in 5 sizes—⅛", ¼", ⅜", ½", and ¾".

Attractive prices — immediate delivery. Write for illustrated circular and price list.



WRITE

Pneu-Trol Devices, Inc.
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SPECIAL BARGAIN #29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW 29.95

3A HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" 5.75
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15¾" 8.50
NO. 3S – Bore 1½", Shaft 1" Stroke 26", Length 23½" 15.75

AN-Hi-Press. HOSE (FUEL – OIL & AIR)

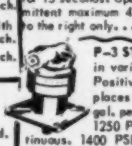
1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.65 each
Same as above but 67" long. . . . . $3.75 each
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each.
Same as above but 36" long. . . . . $2.95 each.

HYDRAULIC TRANSMISSION

Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1.3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 32.50

HYDRAULIC PUMPS

ANGLE PUMP Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. . . . . NEW 17.50

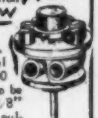


P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max-4500 RPM. Rotation either direction without adjustments. NEW! 17.50

FOUR WAY VALVE

V-17 Poppet type. Pressure balanced. Off at neutral position. Piston type with built-in relief valves for limit of cylinder strokes. Has 5/8" AN tube size (7/8"–14 thread) inlet and outlet. Ports to the cylinder are 1/2" AN tube size with 3/4"–16 thread. Many more in stock. Send for list. 9.75

GEROTOR TYPE PUMP



Logan Gerotor type. For operating hyd. systems on tractors, trucks industrial machinery, etc. Delivers 8 GPM, at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stnd. pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. x 7" lg. Used but guaranteed condition. Now ONLY 19.50

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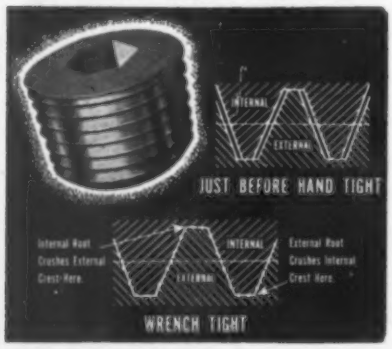

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—SPS—
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Aeroquip Increases Plant Facilities

When the company's new Burbank, California plant went into full operation early in June, Aeroquip Corporation Jackson, Michigan had completed its extensive expansion program which was timed to meet today's demand for greatly increased production. The Burbank plant, located in the heart of the west Coast Aircraft Industry, is operated by Aero-Coupling Co. an Aeroquip subsidiary.

Other important expansion moves recently completed include the addition of a new 65,000 sq. ft. building to Aeroquip's main plant in Jackson, and the acquisition of another subsidiary, Metalco, Inc., with a plant in Cheboygan, Michigan. The total amount of space thus added to Aeroquip's facilities exceeds 100,000 sq. ft.

THE MARKET PLACE

Classified Advertising

Position Wanted

ENGINEER, experience in design of industrial hydraulic circuits (bending, welding, drilling, die-casting, molding, etc.), seeks position as hydraulic engineer. Box 9151 APPLIED HYDRAULICS.

Engineers wanted: Mechanical, aeronautical, electrical, electronic and general engineers with salaries ranging from $3100 to $5400 per annum. Duties of these positions, are to supervise or perform professional work on aircraft: design, construction, maintenance, test, etc. General Engineer jobs require the engineer to conduct technical investigations. Requires knowledge of aircraft construction and operation with emphasis on the materials and designs of parts and components associated with hydraulic flight control systems. Write to the Industrial Relations Department, Naval Air Material Center, Naval Base, Philadelphia 12, Pa.

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Engineering opportunities at Boeing interest me. Please send me further information.

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YOU CAN STEP UP YOUR PRODUCTION AS MUCH AS 30%

....WITH THIS SIMPLE, RUGGED, LOW COST AIR CYLINDER!

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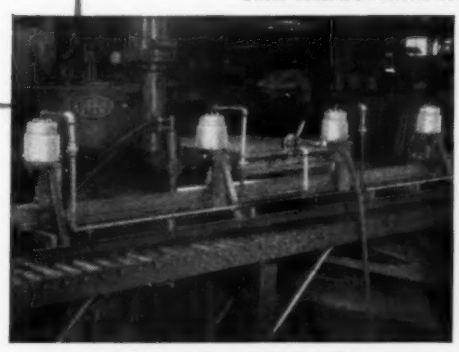
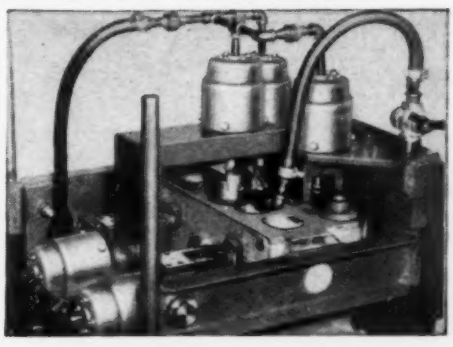


REDUCES OPERATOR FATIGUE

Four Rotochambers installed on the fixture in this spot welding operation replaced cumbersome hand clamps, saving time, greatly reducing operator fatigue.



SPEEDS INSPECTION METHODS

Installation of Rotochambers on this water test operation for engine castings eliminated hand operated fixtures, thereby speeding inspection and cutting costs.

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APPLIED HYDRAULICS' answers to 3 IMPORTANT QUESTIONS

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